AvidBeam Technologies

AvidAuto User Manual

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List of Abbreviations

Term	Description
ATUN	AvidBeam scalable video processing and computer vision platform
DNN	Deep Neural Network
LPR	License plate recognition
ROI	Region of Interest

1 Introduction

AvidBeam Technologies is specialized in video processing, computer vision, and video analytics products and technologies. This document describes AvidBeam AvidAuto product which is intended for traffic, parking, and similar applications. The document highlights the main features of AvidAuto, the hardware and software requirements, configuration and integration of AvidAuto with cameras and/or other VMSs, extension of AvidAuto to support new functionalities, and other related information.

2 AvidAuto Highlights

AvidAuto analyze camera streams or video files using the state of the art Deep Neural Network (DNN) models and computer vision algorithms. AvidAuto uses several models for vehicle detection, plate detection, and number plate extractions as shown in Figure 1.

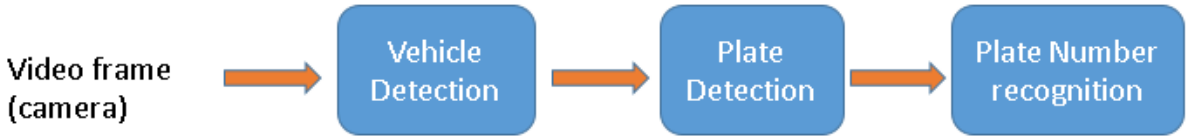


Figure 1 Frame Processing Sequence

Recognized plate numbers are stored in a database for customized search and queries. AvidAuto can be installed on a private or public cloud where it can manage many cameras simultaneously.

AvidAuto is powered by AvidBeam ATUN platform for scalability purposes. ATUN is a platform for scalable video processing using different plugins where each plugin can perform a dedicated computer vision or video processing functionalities. ATUN includes many other built-in features such as database management, result visualization, result filtering and query support.

2.1 AvidAuto Feature List

The main features of AvidAuto can be summarized in Table 1 below

Table 1 AvidAuto Feature List

Feature	Description
Input	• Camera(s) • RTSP stream(s) • Video file(s)
Analytics	• Vehicle detection

Feature	Description
	• Vehicle Tracking • Automatic license plate recognition (ALPR) • Car counting
Countries	• Egypt (default)
Web Interfaces (views)	• DASHboard • Cars • List • Tracking • Camera settings
DASHboard	• Total vehicle count • Latest captured images for each camera • Alert/notifications for cars defined in user lists • Daily statistics per camera
Cars	• Display history of all recognized cars • Allow user to search for a specific car using • Car plate (or partial plate number) • Plate type (specific to Egyptian plates): private, taxi, trucks, diplomatic, etc. • Camera (or gate): specify a specific camera/gate to search cars recognized at. • Start date/End date: Search only cars during these dates. • Save list in PDF file. • Display number of cars in graph instead of list.
Lists	Create, view, and modify clients list
Tracking	Display cars recognized in defined lists
PDF generation	Generate PDF reports for user query or displayed results
Scalable	AvidAuto supports large number of cameras
Customizable	AvidAuto can be easily extended by adding new pluggable modules for different functionality, extending existing modules, or extended web interface functionality
Accuracy	Car Detection ~98% Plate number recognition ~96%

3 AvidBeam ATUN Platform

AvidAuto is powered by AvidBeam ATUN platform for scalability purposes. ATUN is a platform for scalable video processing using different plugins where each plugin can perform a dedicated computer vision or video processing functionalities (Figure 2). ATUN

includes many other built-in features such as database management, result visualization, result filtering and query support. Those features facilitate development effort and time for other applications.

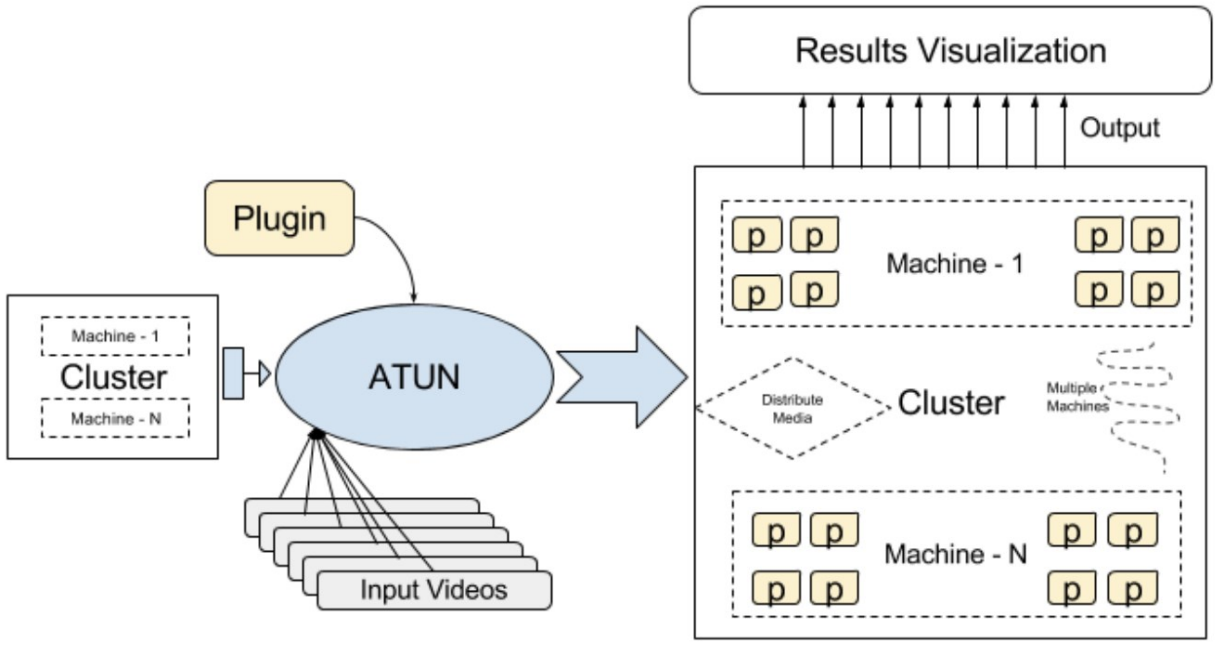


Figure 2 AvidBeam ATUN

ATUN provides easy API for applications like AvidAuto which can be used to extend ATUN UI by adding customized UI, customized processing plugin, or both as shown in Figure 3.

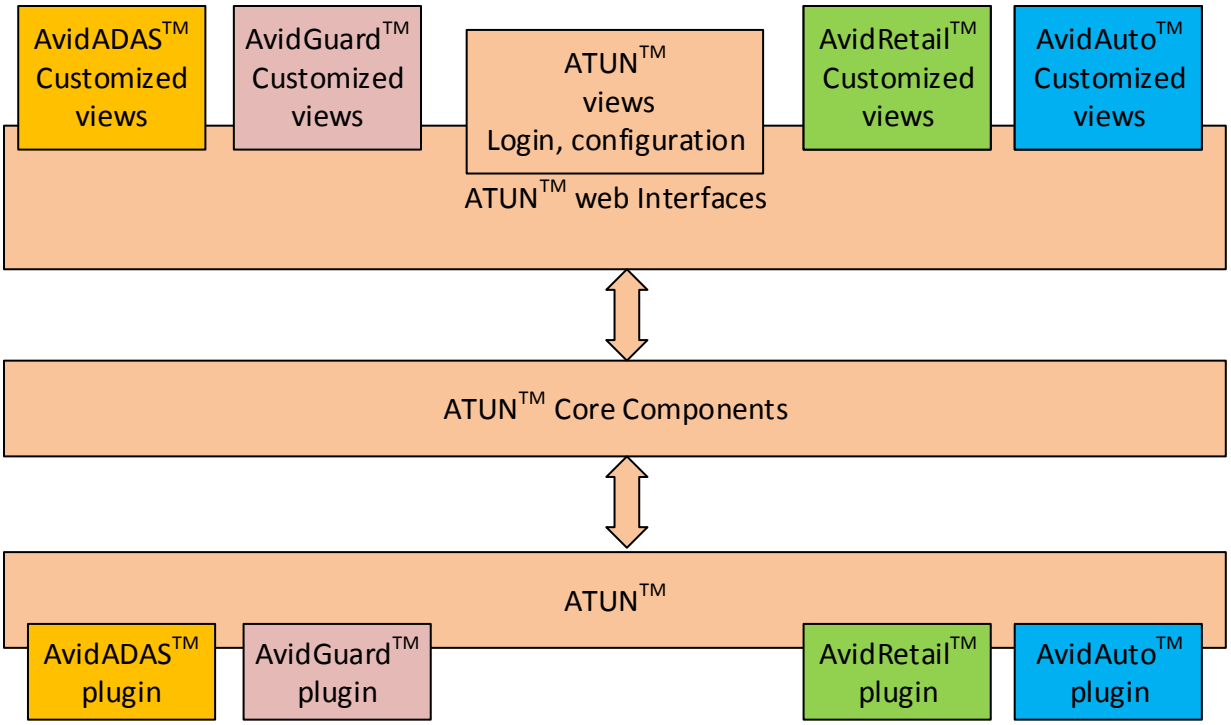


Figure 3 Relationship between ATUN and Related products

Figure 4 shows typical data flow in AvidAuto. ATUN platform manages camera connections, database storage, and web interface restful API calls. ATUN also manages plugin scalability and video data distribution and load balancing for best performance.

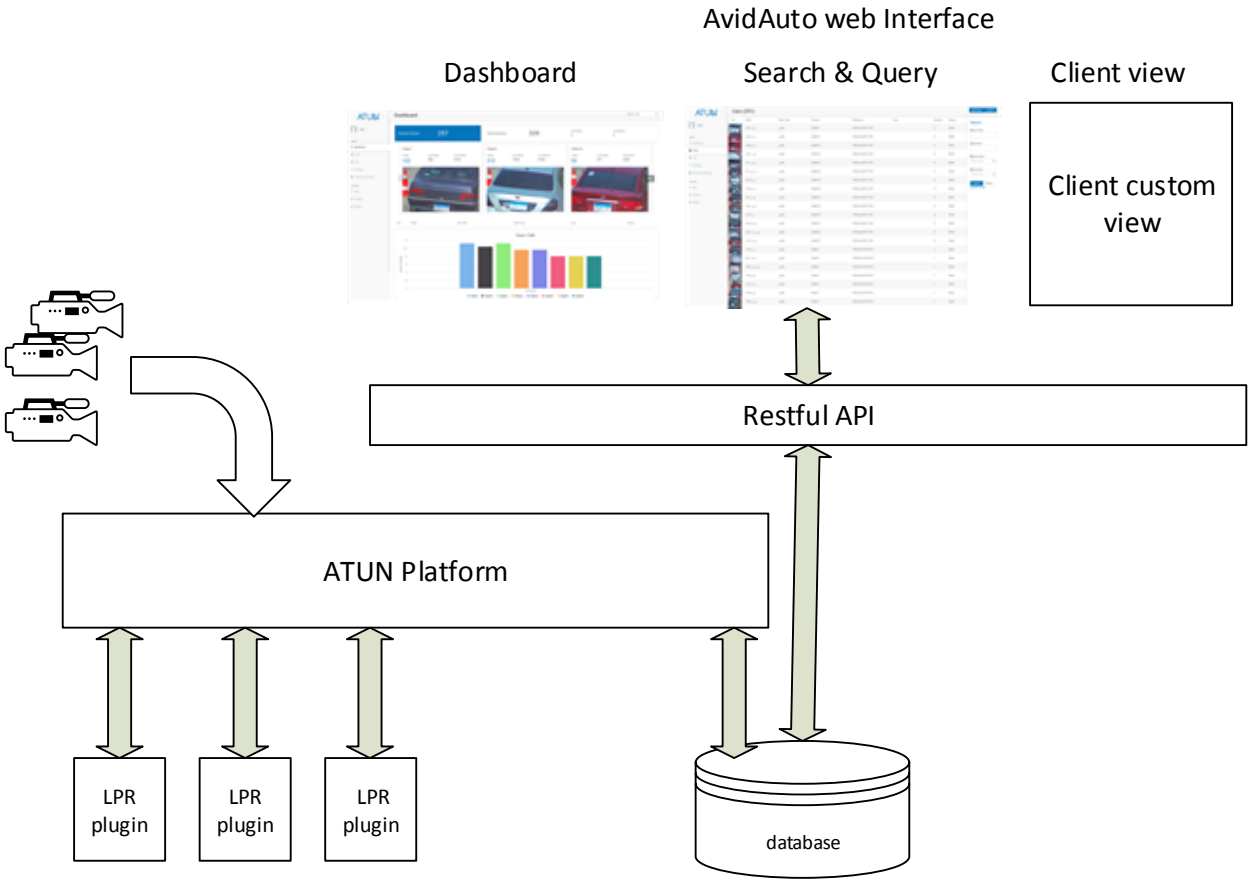


Figure 4 AvidAuto Data Flow

4 AvidAuto Web Interfaces

AvidAuto has several web interfaces (views). In addition to this, custom user views can be added and integrated with AvidAuto using Restful API. This section describes the defaults views that are available upon installing AvidAuto. Currently AvidAuto is shipped with the following main web interfaces:

1. Dashboard
2. Cars
3. List
4. Tracking
5. Camera settings.

4.1 Dashboard View:

The Dashboard view provides a live summary for the entire solution as shown in Figure 5.

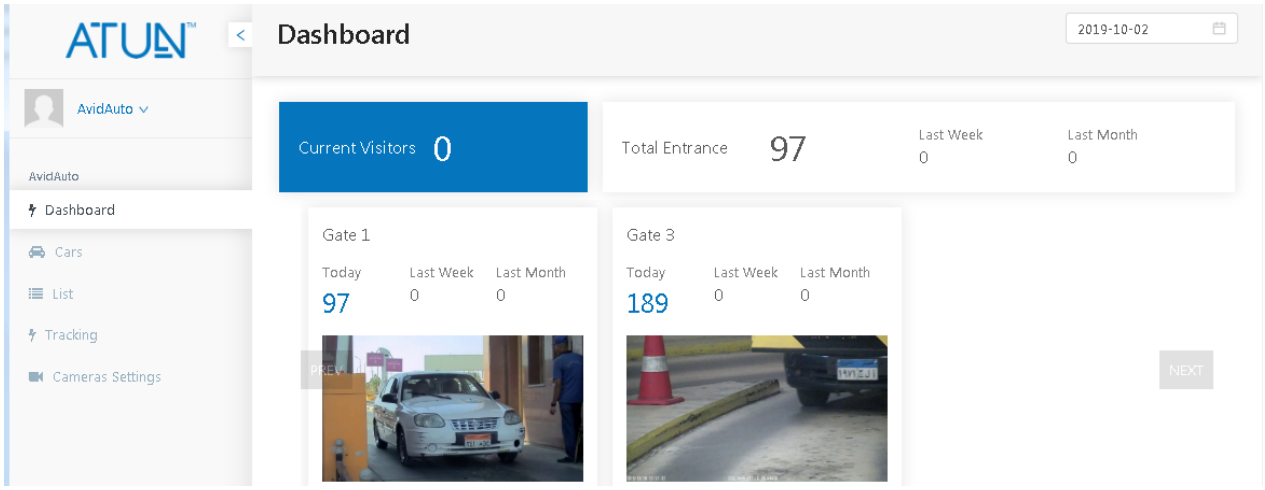
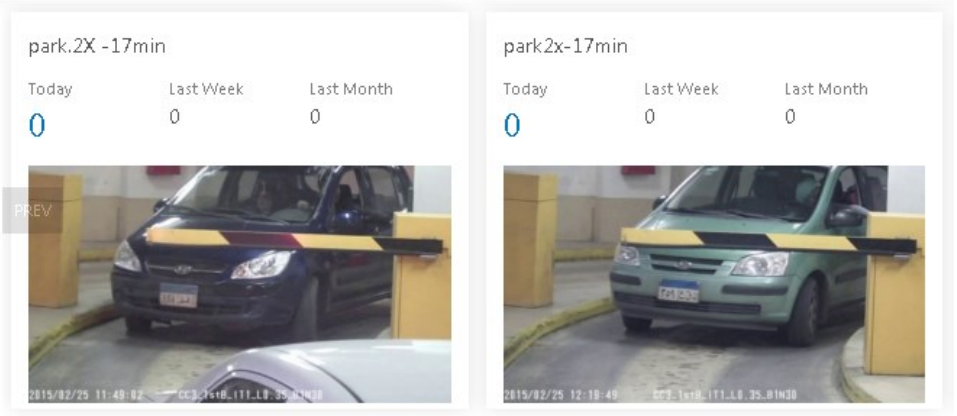
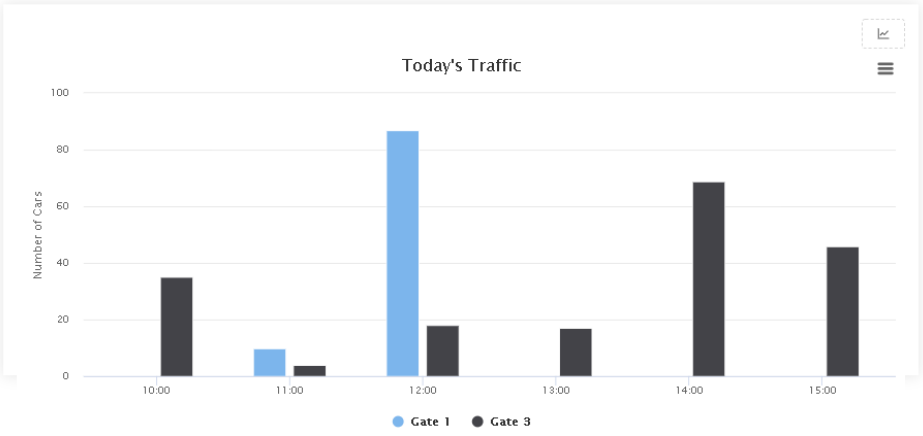


Figure 5 AvidAuto Dashboard View

Examples of provided information are listed below

Table 2 Description of Dashboard View Elements

Item	Description
Count Visitors	Displays the number of visitors currently in the area covered by AvidAuto for all cameras. 
Total Entrance	displays many plates entered today, last week and last month for quick summary 
Thumbnail	Displays images for last detected plate for live feed in addition the total amount of plates detected from each active camera compared to last week and last month as shown Figure 5

Item	Description
	
Graph	Represents a 24 hours summary for the traffic flow starting from 12:00 am till 11:59 pm as shown in Figure 
Dashboard date	Placed in the top right corner of the view. Date element shows the date associated with the displayed information. Date value is defaulted to current day date but can be changed by user. 

4.2 Cars View:

In Cars View, results are displayed in timed order as shown in Figures 6 and 7.

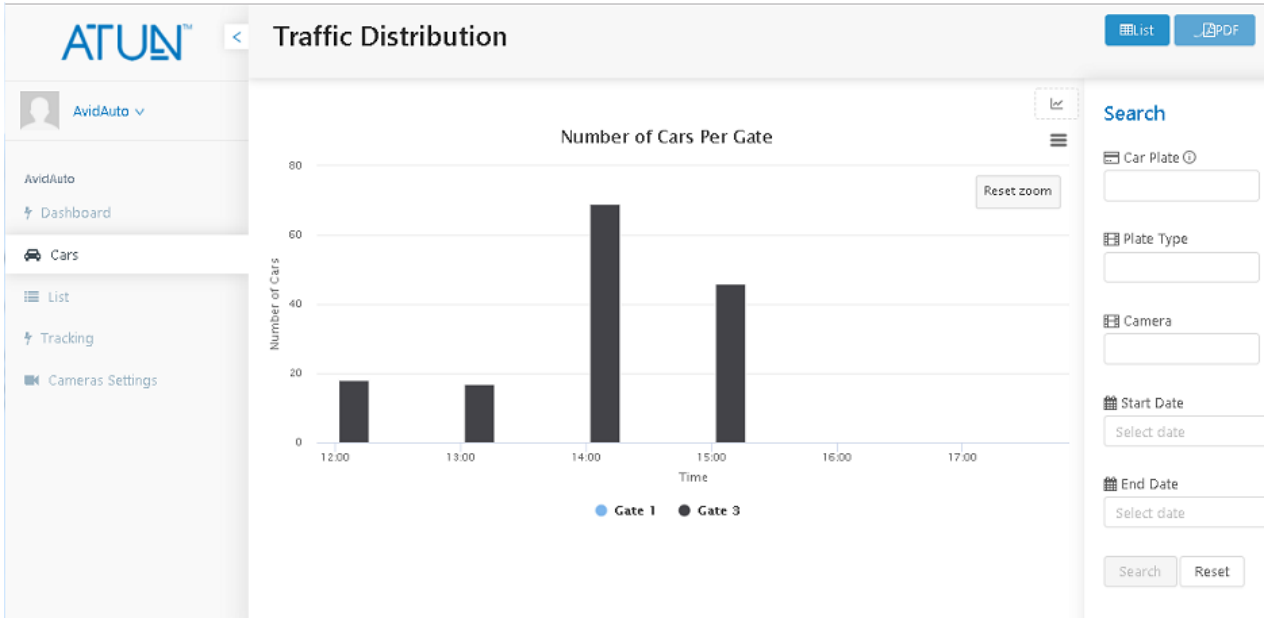


Figure 6 AvidAuto Cars View- Car graph

Figure 7 AvidAuto Cars View- Car list

Cars view provides

- **Filter results** per camera, plate-type, plate color, or duration as shown in Figure 8
- **Search** by plate or by numbers or partial plate number (Figure 9)
- **Car spotting details:** numb clicking on any car thumbnail can display car spotting details as shown in Figure 10.
- **Generate PDF Report** for a certain plate including detail as shown in Figure 11

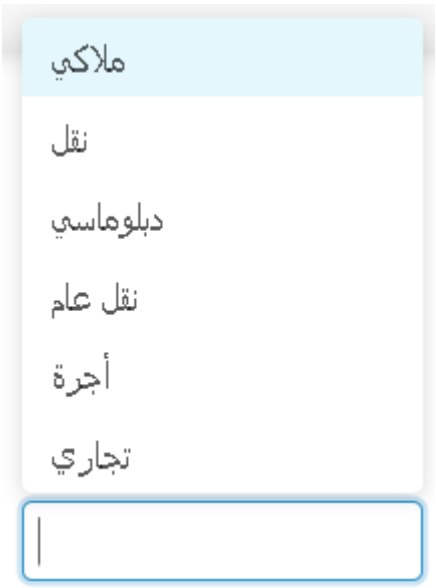


Figure 8 AvidAuto Supported Car Types

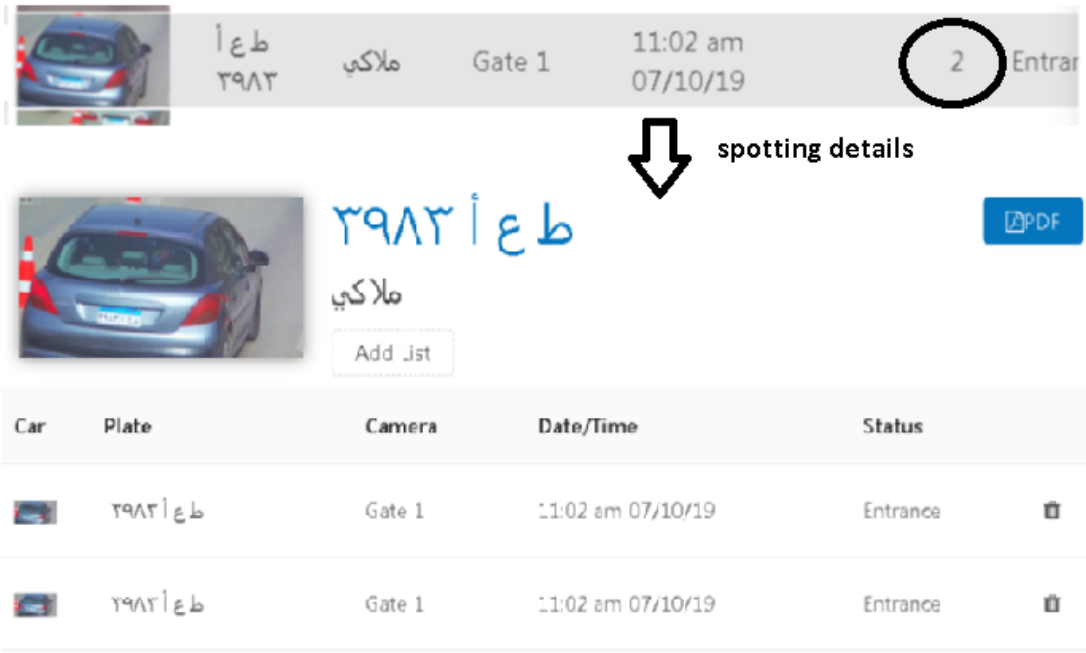


Figure 9 AvidAuto Plate Details View

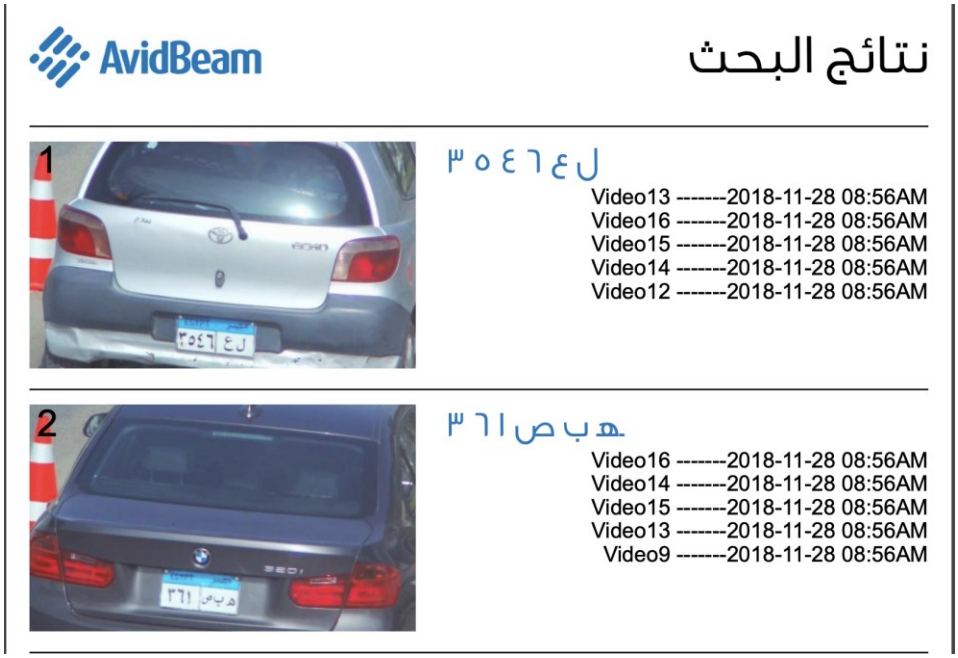


Figure 10 AvidAuto Report with Detailed Records for Each Plate

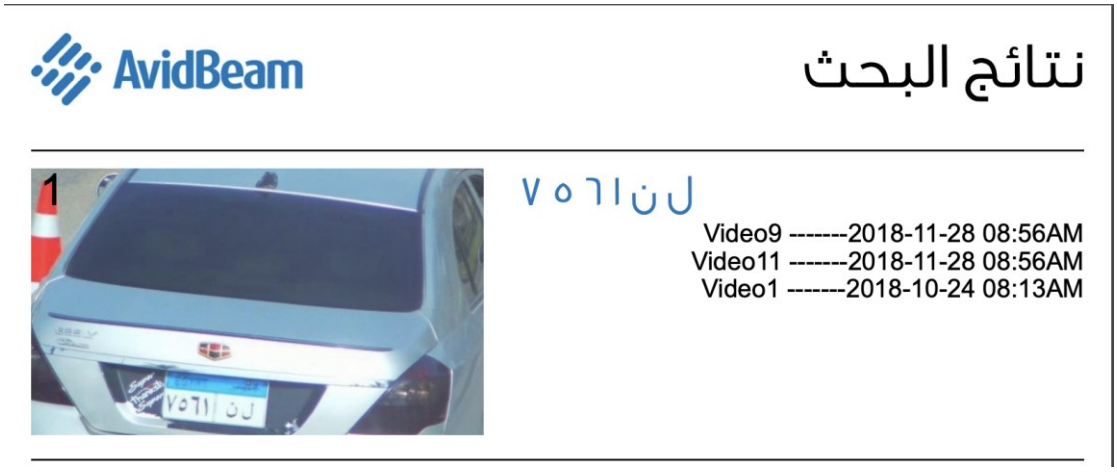


Figure 11 AvidAuto Plate Details Report

4.3 List View:

The List View (Figure 12) is used to define custom car list such as white list, black list, or other lists. User provide plate number for each car defined in any list. In addition, each list has a unique color selected by user.

Figure 12 AvidAuto List View

Any car spotted that exists in any list will be shown in the Dashboard view as well as in the tracking view (described later in the next section). User can add cars to more than one list. By default, AvidAuto has two lists, black and white lists, or new created list like the Avidbeam List shown below in Figure 13.

Lists are used for multiple scenarios such as:

1. Add Stolen Plates to The Black List
2. Add VIP persons to white list to alert operators or security guards upon spotting their cars.

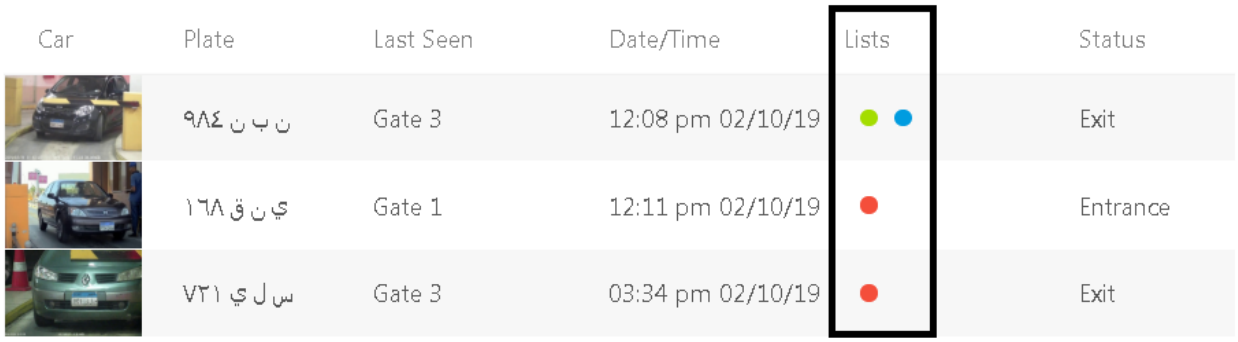


Figure 13 List Tracking in AvidAuto. Each plate includes the color code of the list the plate is defined in.

4.4 Tracking View:

The Tracking View is a table to track all the predefined plates in the list View as shown in Figure 14.

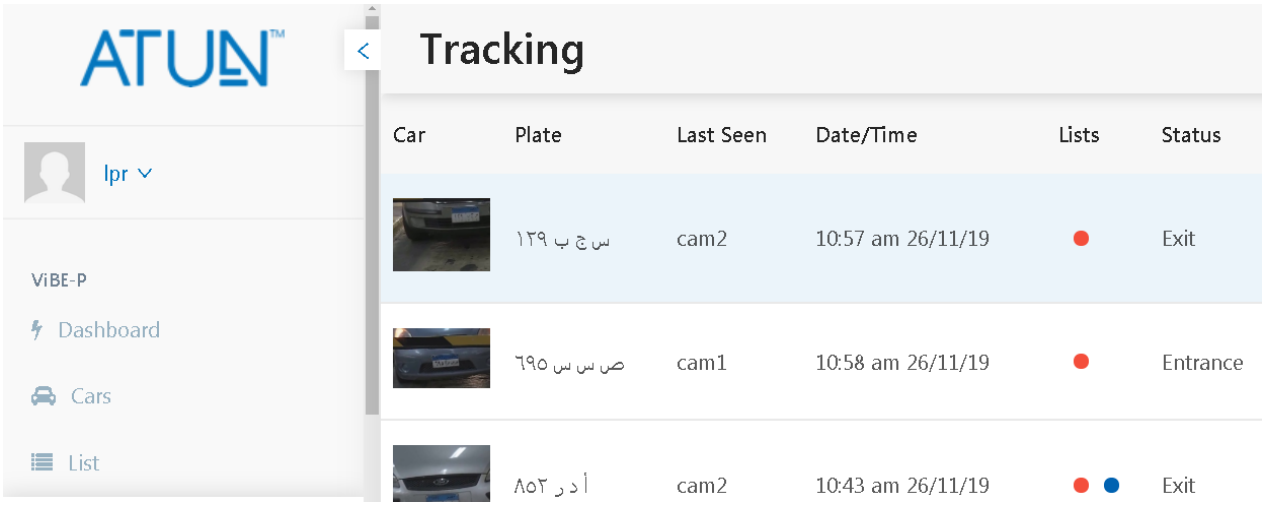


Figure 14 AvidAuto Tracking View

4.5 Camera Settings:

Camera settings view enable user to define camera direction. Any camera can be specified as either entrance (gate) camera or exit (gate) camera.

5 AvidAuto Installation and Configurations

This section is intended for AvidAuto administrator not ordinary user. The administer should be familiar with ATUN platform installation and configurations. More specifically how to upload plugin, configure media input, and create, start, and stop processing job. A more detailed description can be found in ATUN installation and configuration guide. This section focuses more on AvidAuto specific requirements and installation details.

The following sequence of operations are required for a successful installation and launching of AvidAuto.

1. Provide sufficient hardware for the target installation and deployment.
2. Purchase/obtain AvidAuto license from AvidBeam Technologies
3. Download Installation package from AvidBeam and start installation
4. Configuring AvidAuto with existing cameras and other configurations.

The following subsections explain each step in more details.

5.1 AvidAuto Hardware Requirements

AvidAuto is supported only under Ubuntu. AvidAuto/ATUN requires a master machine for storing databases, managing processing, handling user search queries, etc. In addition to the master machine, additional processing machines or slaves are needed. The number of slaves depends on number of cameras connected to AvidAuto and their specifications.

5.1.1 Processing Hardware

The processing requirements varies according to many factors

- Number of cameras connected to AvidAuto
- Camera configurations such as resolution, frame rate, compression type (H.265, H.264, MJPG, etc.)

Table 3 lists the recommended hardware requirements for 16 cameras on 720 resolution

Table 3 Hardware Requirements for AvidAuto

Resolution	Number of Camera	FPS	GPU Memory (Gbytes)	CPU Thread (virtual cores)	CPU memory (Gbytes)	GPU
720p	1-16	15	11	14	16	RTX 5000
720p	1-5	15	2	4	5	1050 TI

5.1.2 Recommended Camera Specifications

The recommended camera view for best accuracy is shown in Figure 15.

Figure 15 AvidAuto Camera View

The recommended camera specifications are listed in Table 5 below

Table 4 lists recommended/validated camera models

Item	Description
Resolution	2 MP camera (HD or 1920 x 1080p)
Camera Lens	4.7-84mm
Streaming bitrate	6-8 Mbps
Other features	WDR (wide dynamic range)
Video Encoding	MJPG (preferred) H.264

Item	Description
Car Plate size	200x100 for accurate detection
Recommended models	Avigilon 2.0C-H4A-B1: http://4a54f0271b66873b1ef4-ddc094ae70b29d259d46aa8a44a90623.r7.cf2.rackcdn.com/assets/Uploads/avigilon-h4a-b-b-datasheet-en-rev8.pdf

5.1.3 Storage Requirements

AvidAuto has a retention policy which allows client to specify a duration during which plate data will not be removed from the database.

AvidAuto storage requirements are very small compared to a typical VMS. Only images of detected car plates are stored. On the average for a single database record requires approximately **150k-200k** bytes of storage based on camera resolution and selected ROI. Table 4 below lists the estimated storage for a traffic load of **1000 car/day**.

Table 5 estimated Storage for AvidAuto

#cars/day	Record / Car (Kbytes)	Storage/day (Mbytes)	Storage / week (Gigabytes)	Storage / month (Gigabytes)
1000	150-250	150– 250	1 – 1.75	5-7

5.2 AvidAuto Licensing

A license agreement with AvidBeam must be signed before the client can install AvidAuto in their data center. The license is usually based on certain aspects such as the maximum size of data input, number of simultaneous running instances, plugin included in the installation.

Upon product purchase, AvidBeam will provide system administrator with a user account as well as a 48-character product key. Client should use this product key during installation, license renewal or upgrade, or during any contacts with AvidBeam technical support team.

5.3 AvidAuto Installation

AvidAuto should be installed on Ubuntu 16.04 based machine. It is highly recommended to have a fresh Ubuntu installation before installing AvidAuto without any other software that could conflict with AvidAuto. AvidAuto installation package contains the following items

1. **Install ATUN platform**: Since AvidAuto runs only on ATUN platform, ATUN must be installed first. Once ATUN is installed, user can run ATUN and launch ATUN web interface to add AvidAuto custom modules. Figure 16 shows ATUN login web interface which is the main entry point. A user should login with an admin account admin@avidbeam.com, which was created during installation, in order to finish the installation. The password is the password the user supplied during installation.

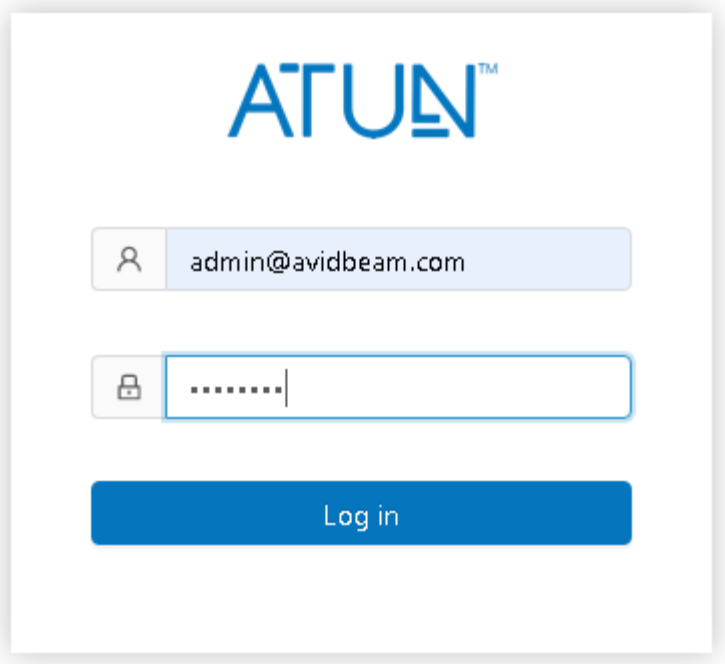


Figure 16 ATUN login screen

2. **Install Custom AvidAuto modules**: Several AvidAuto custom modules will then be added to ATUN using Admin account. Those modules are
    a. AvidAuto preprocessing plugin. This plugin perform data preprocessing tasks before executing the actual plate detection algorithm. .
    b. AvidAuto processing plugin. This is the main processing algorithm which detect and recognize car plates in input video stream or file.
    c. AvidAuto reducer/Post processing. This module handles the post-processing phase in which case plate number is validated and stored into DB.
    d. AvidAuto UI plugin. This plugin contains AvidAuto custom web interfaces that were described in section 4 of this document.

5.3.1 Uploading AvidAuto plugins ATUN

AvidAuto plugin is provided in the installation package with extension (.so). In order to add a new plugin to the platform, please follow these steps:

1. Click on the “Plugins” link on the left panel as shown below

Figure 17 ATUN Plugin View (add new plugin)

1. Click on “New”: The plugin dialog shown in Figure 17 will appear.
2. Set the plugin name. Select any name
3. Upload your plugin executable **“LPR Plugin.so”**
4. Upload any additional dependencies in the jar file **“Meta.jar**
5. Select **non sequential** for current AvidAuto release
6. Uncheck **GPU Plugin** for current AvidAuto release.
7. In the Reducer field, select **“LPR Reducer.so”**
8. To save your configuration click Create or click close if you wish to cancel

Repeat steps **1-4** and **8** above to load the Pre-processing plugin **“Preprocessing.So”**

Upon clicking save the configuration form disappears and your plugin should appear in the ATUN existing plugin list as shown below

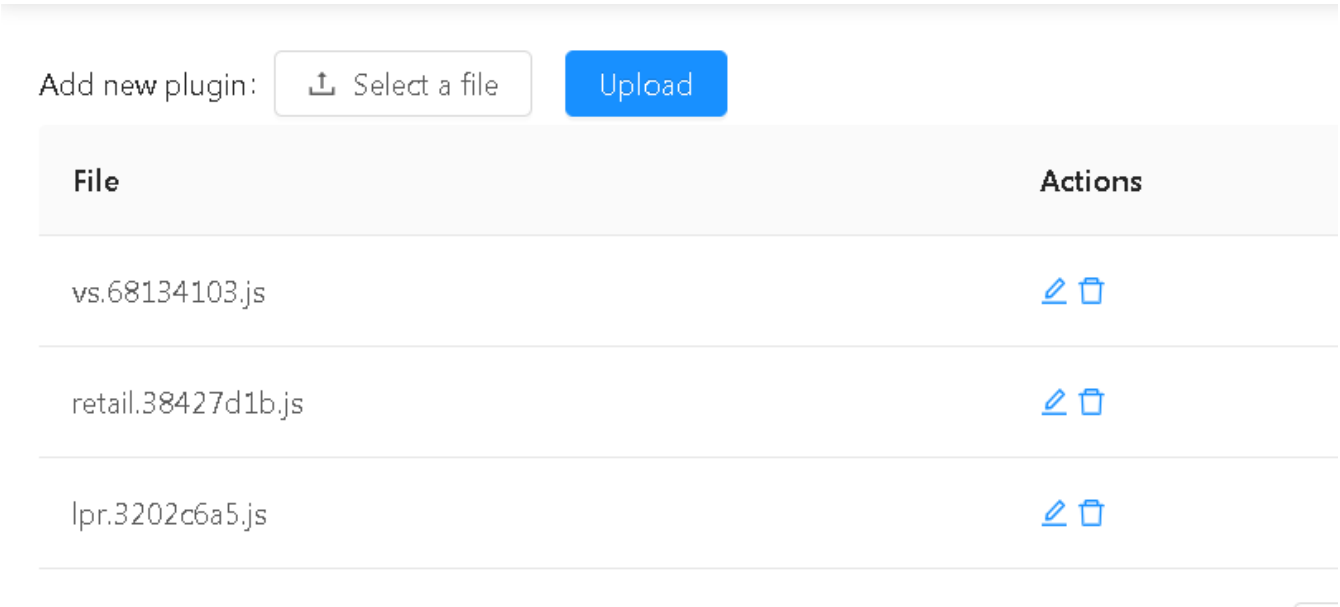


Figure 18 Plugins page, a list of all available plugins

5.4 Configuring AvidAuto

Once ATUN and AvidAuto plugins are installed, The admin user should proceed to the configuration phase where the following actions should take place

1. Configure input source (camera or video file)
2. Create the processing job that combines the input media with the corresponding plugin
3. Configure custom plugin parameters.
4. Start the processing job.

5.4.1 Configuring Input Source

Live media is defined as RTSP streams.

A live stream can be configured as shown below:

1. Specific a name for the input camera
2. Set the media type. For live media streams, select “Real Feed” from the drop down list
3. Set the URL of the specified stream (ex.: rtsp://my_ip/defaultPrimary?streamType=u)
4. Set the media stream frame rate
5. Choose whether to enable pre-processing for this stream or not from preprocessing field.
6. Click create to save your changes or close to cancel

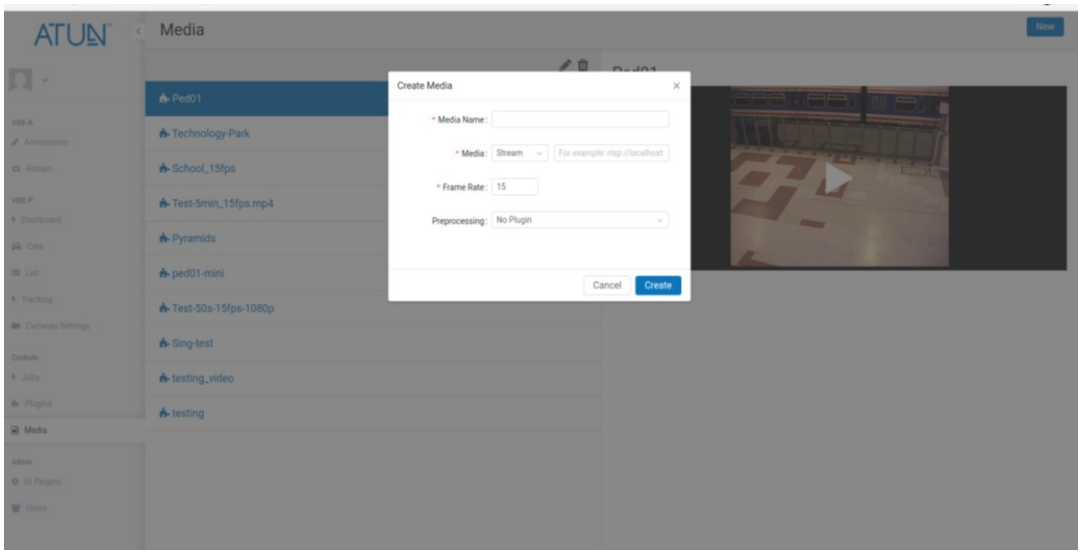


Figure 19 Add new live media source

7. Upon clicking save, the configuration form should disappear and your newly created media source should appear as shown below, Figure 20.

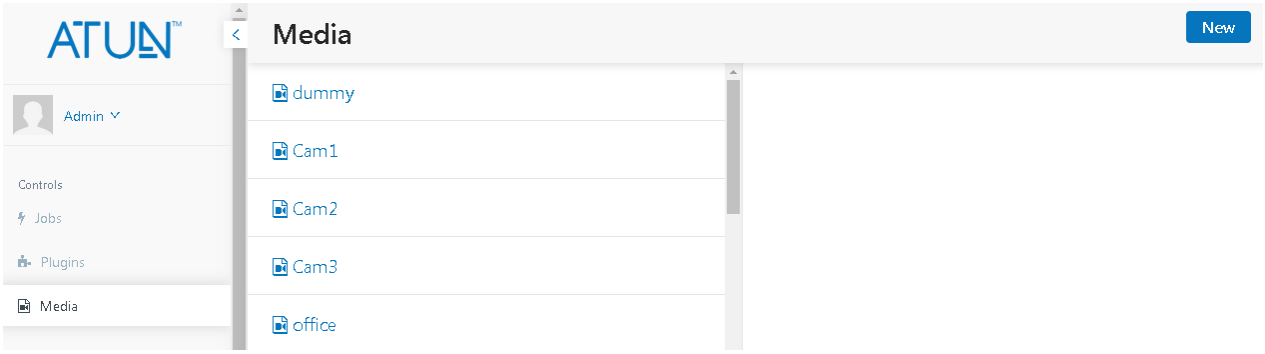


Figure 20 newly added live media source

5.4.2 Create the Main Processing Job

AvidAuto processing job requires at least

1. A processing plugin.
2. Input media (data) source (video file or stream).

Those components have been uploaded already as described in the previous two sections. Other. Media and plugin are added during job creation as will be explained in this section

To create a new AvidAuto job:

1. Click on the jobs link in the left panel
2. **Create new job**: Click on “New Job”

a. Set the new job name
b. Select if this job is to run a plugin running a tracking algorithm. In AvidAuto, **do not set**

c. Select the amount of memory (RAM) used by every instance of the plugin. For AvidAuto, **select 1.5 Gbytes**.

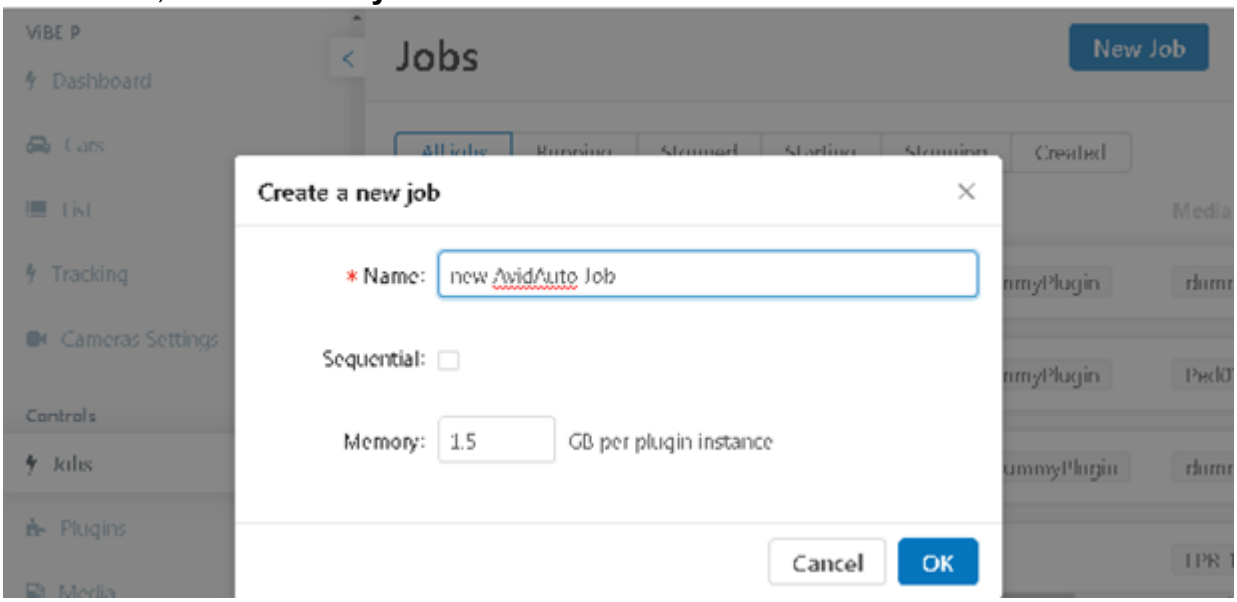


Figure 21 configuring a new job

d. Click OK to save your settings or close to cancel

e. Upon clicking save, your newly created job should appear as shown below

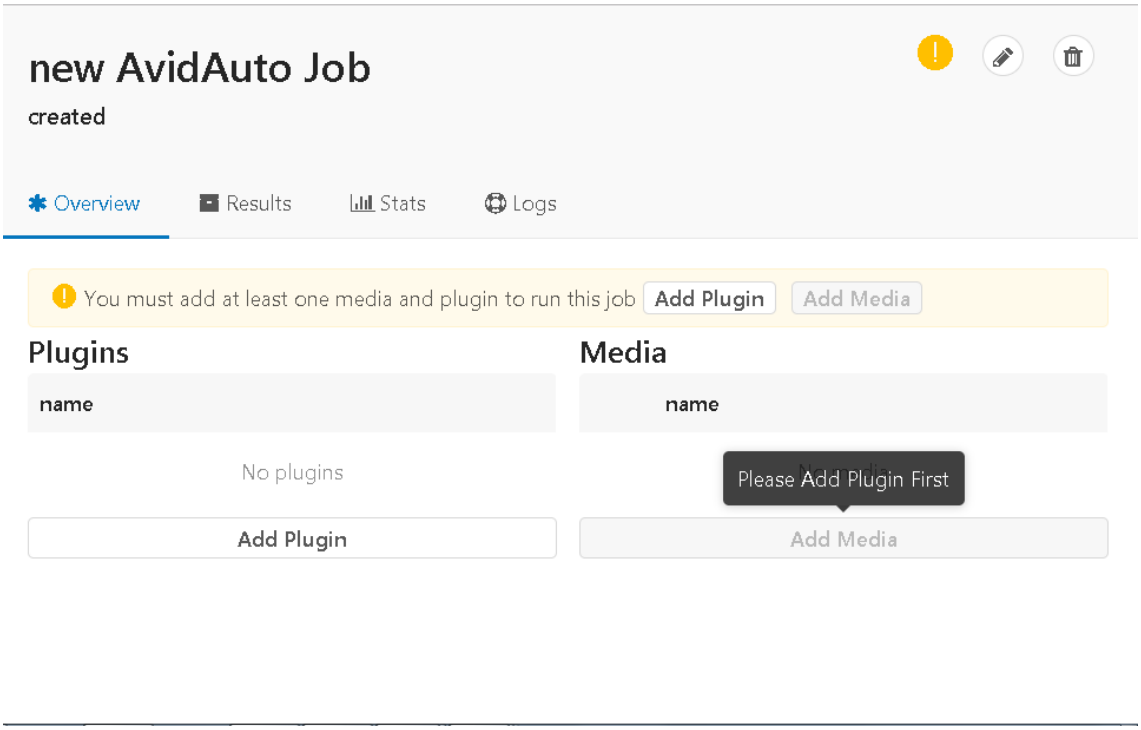


Figure 22 Created new Job

3. **Add AvidAuto plugin** by click on Add Plugin button. Set number of instances required by the plugin which should be less or equal the number of instances

approved in AvidAuto license

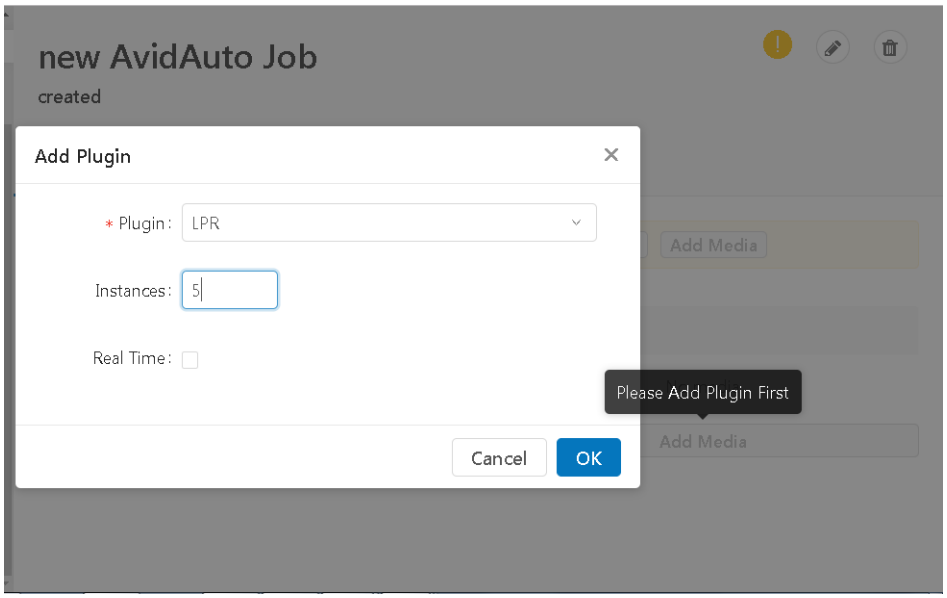


Figure 23 Edit plugin Instances

4. **Add media** to a created job as shown in Figure 24

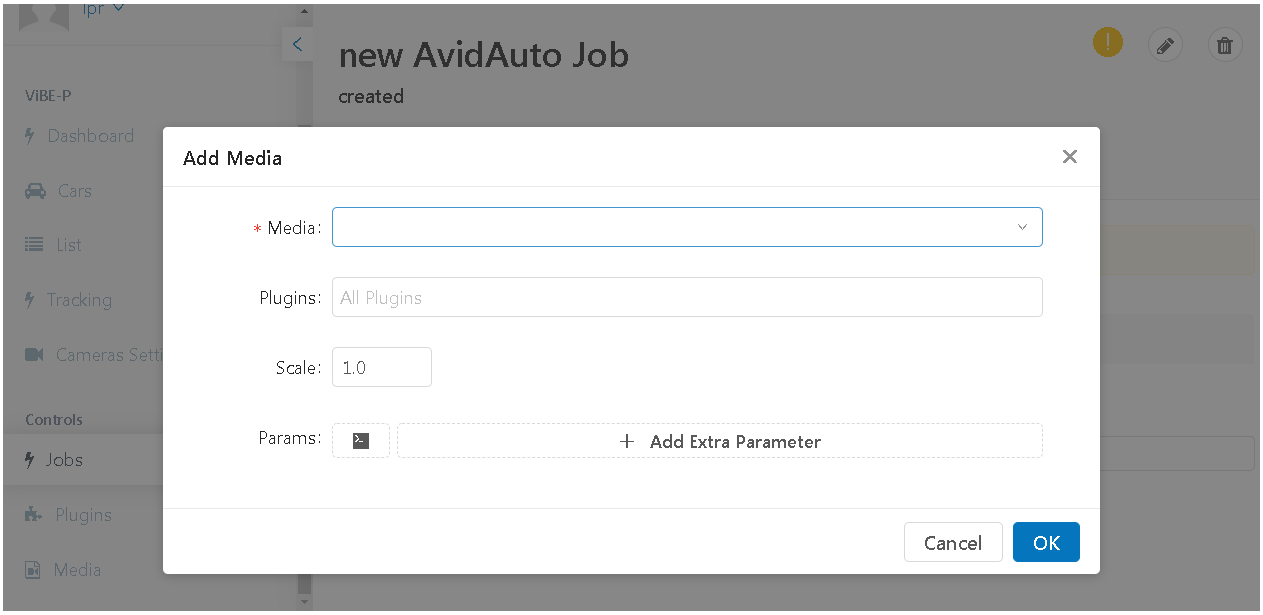


Figure 24 Add Media to Created Job

Once a media input is selected, administrator can configure the media by specifying a region of interest (ROI) where the search for the license plate will be performed as well as any additional preprocessing plugin as shown in Figure. The selection of ROI is important in order to avoid parts of the scene such as walls, trees, mirrors, etc. that could cause recognition errors. There is no other media configuration parameters in AvidAuto

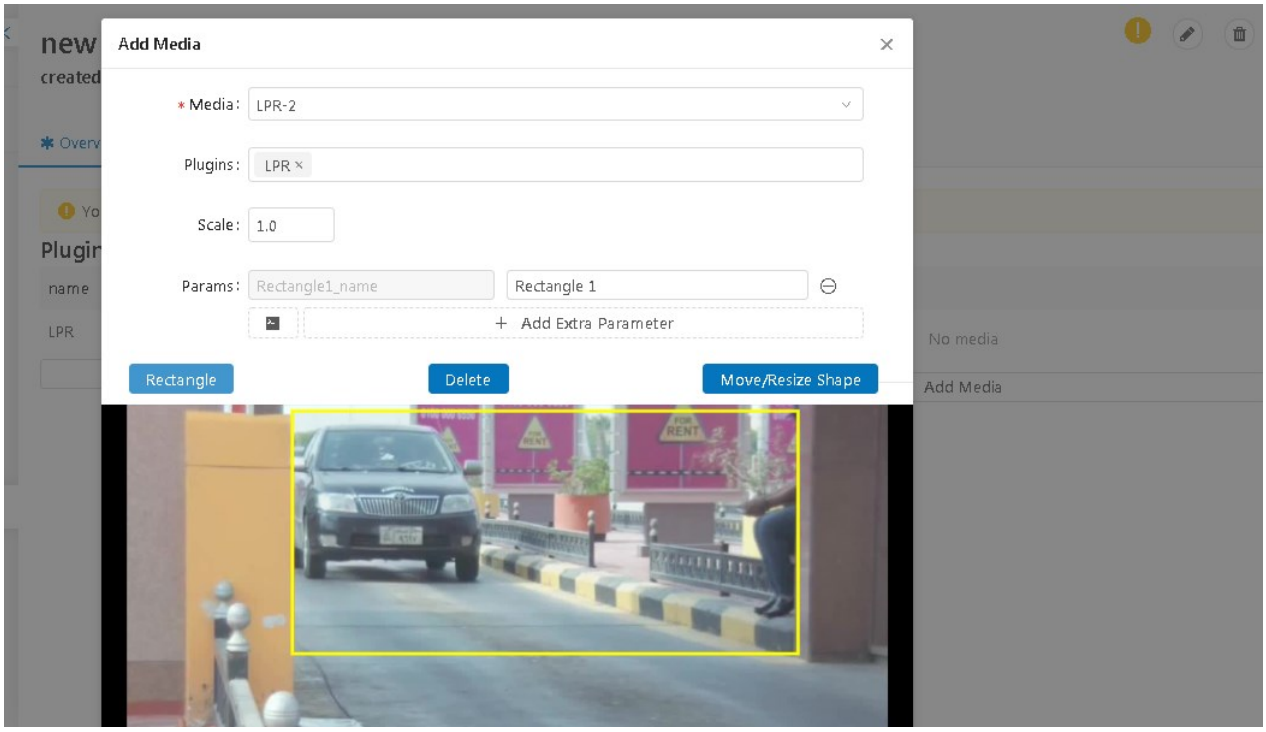


Figure 25 Media Configurations

5. At this stage, both plugin and media have been specified, administrator can start the job by clicking the green start button at the top right corner of the view

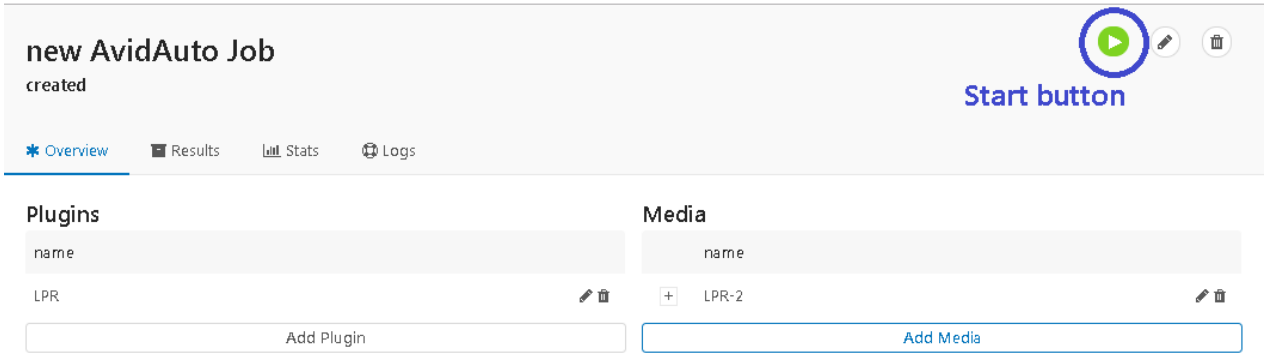


Figure 26 Starting Job

At any moment, administrator can stop, edit the job to modify it and restart it again. Administrator can also delete the job and create a new one. The processing results should start to appear in AvidAuto DASHboard, Cars, and List Tracking views.

6 References

1. ATUN installation Guide. Available through AvidBeam.
2. AvidAuto API user guide.

7 Appendix

7.1 Extending AvidAuto Functionality

There are several approaches that can be used to extend AvidAuto functionality and add new un-supported features in the provided release. These approaches can be summarized as follows

1. Plugin Upgrade: communicate new required feature to plugin owner which could be AvidBeam Technologies, AvidAuto client who license this product from AvidBeam Technologies, or other 3rd party company who deliver the used plugin
2. Creating a new plugin: Using AvidBeam ATUN SDK, client can develop their own plugin and integrate it with AvidAuto. A license from AvidBeam may be needed to enable the new plugin to run with AvidAuto

7.2 Extended AvidAuto Web Interface

AvidAuto database can be access via RestFull API. Client can use any web programming language to communicate with ViBE-P API through any native HTTP library. The API is divided into five basic categories (authorization, car queries, list queries, and media)

1. Authorization: for user login and access

2. Car queries: search for a certain car with specific details

3. List queries: query client defined list such as black list, white list, and other custom list

4. Media queries: query installed cameras and retrieve their detailed information

5. Models: provides a details description for the JSON objects existing in ViBE-P models

AvidAuto RestFull API is provided as a separate attachment.

7.3 Exceptions and Trouble Shooting

7.3.1 Electricity was cut off the server:

Open the server

Open the Browser and go to this url "http://localhost:7777"

Log in as the admin user

Open the Jobs page and check the status of the current Job if working or not. if not start the Job and the system will start processing

7.4 2. Any of the Streams was down while the system is processing

Open the Browser and go to the server's url

Log in as the admin user

Open the Jobs page and restart the job running so the camera could be added to the list of media again

7.5 3. System Stopped working for any reason

Open the Browser and go the system's url

Login as the admin user

Open the Jobs Page

Choose the Job that was running from the list

Restart the job and in case it was already stopped just start it