PREDATOR SCORPION V2

Owner's Manual V1.0

Contact

If you run into any problems, have questions, or need help, don't hesitate to get in contact!

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Introduction

Thank you for supporting the development of Predator by purchasing a preconfigured kit from V0LT! This document contains important information about building your Predator system.

Disclaimer

This document is an overview of the steps required to install and use your Predator system. However, different installation packages may come with different components. As such, your kit may not contain all of the components or features listed in this document.

Features

Here is a brief overview of the features supported by Predator:

Transparent

Predator is completely open source, which makes it perfect for privacy-conscious users or hobbyists who want to tinker with their system.

Modular

Predator is unbelievably modular, and works with a huge collection devices. In the event that you want to upgrade or repair your system in the future, nearly any USB webcam, USB GPS receiver, Linux computer, or router will be compatible with Predator!

Secure

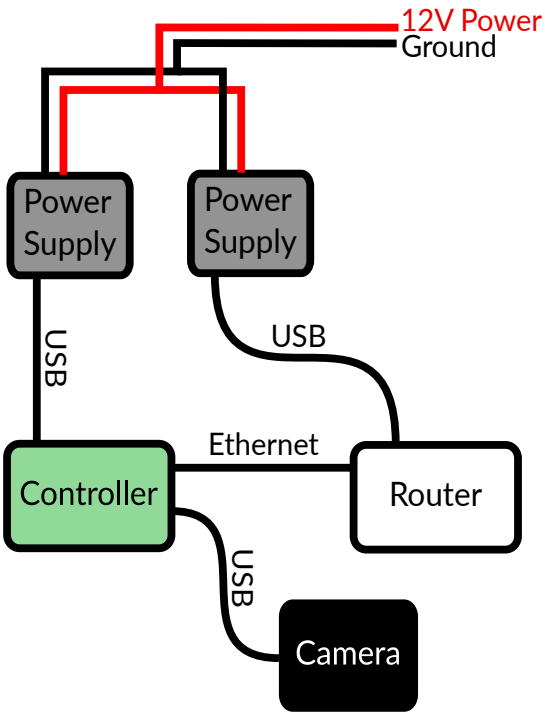
Having the controller installed separately from the camera unit makes your system significantly more secure by making it dramatically more difficult for a thief to find and access the device containing your stored ALPR data.

Wireless

Your installation kit includes the ability to interface with Predator over a local WiFi network. This allows you to quickly change settings, transfer video, and interact with Predator using your smartphone, laptop, or tablet, even without access to an internet connection.

Overview

While the number of components may seem daunting, the installation process for your Predator system is similar to installing a traditional all-in-one dash-cam. This is an overview diagram showing how all of the components in your kit connect to each other.



The "Controller" is the LibreComputer SBC, which is the brain of your ALPR system. It's responsible for recording, processing, and storing ALPR data.

The "Router" is the GL-SFT1200 travel router. This is only included in the "Enhanced" package (or higher).

The "Camera" is the USB camera, which connects to the controller via USB, and allows it to capture license plates. Your kit may include multiple cameras.

Planning

The most technical part of the installation process is determining how to get power to the power supply harness that connects to the router and controller. You'll need to figure out how get 12V power to the red wire, and ground to the black wire. The most common way to do this is with a "fuse tap", which allows you to tap into an existing fuse in your car's fusebox. This method requires some technical experience, but should result in a very professional and concealed install. Alternatively, you can solder a 12V barrel plug connector to the included power supply harness, and connect it to an existing 12V outlet in your car. Make sure your power solution allows the power harness to reach the controller and router. If you don't feel qualified to install your Predator kit, try to find a mechanic with automotive electronic experience. V0LT is not responsible for damaged caused by improper installation.

Once you've determined how you want to power your Predator system, the next thing to consider is where you want to place the controller and router. This step is very open-ended, and depends significantly on how concealed you want your system to be. While deciding, keep in mind the length of the webcam cable, as well as the length of the wiring for your power solution. Be sure to keep all components and wiring way from moving parts, airbags, and other potentially hazardous locations. Here are some locations to consider, ranging from quick and easy, to highly concealed and professional.

- Attached to the dashboard
- Underneath the passenger seat
- Attached to the roof of the trunk compartment
- Inside the glove-box
- Below the center console
- Embedded in the dashboard
- Behind the rear-seat padding

Camera

The included primary camera is an industrial USB camera with a metal housing and removable lens. The included lens features adjustable zoom, focus, and aperture. You should make sure the primary camera is configured appropriately before using your Predator system.

Focus

While your installation kit should come with the lens focus already adjusted appropriately for long-range ALPR use, you may need to adjust it to better fit your use-case. To make adjustments easier, consider connecting the camera to a laptop or desktop to view the video output in real-time. The camera uses a generic driver that should be preinstalled on all major operating systems without any additional software, and you should be able to open it using VLC, MPV, OBS, or similar video software.

Generally, you should try to configure your camera lens so vehicles ranging from 1 car length to 7 car lengths ahead will be in focus and in frame. This makes it possible to detect license plates when stopped behind vehicles at intersections, as well as following behind at a normal following distance while driving. Partially closing the aperture will increase the size of the usable focal range at the expense of low light performance. You should try to keep the aperture as open as possible while still keeping license plates at the extreme ends of the focus range readable.

Mounting

The included primary camera uses 1/4th inch tripod-style mounting points. Depending on availability, some included cameras will have mounting points on both the top and bottom of the camera unit. If you want to attach your camera to the dashboard, you would attach the mount on the bottom of the camera, while an installation that hangs the camera from the windshield would use the mounting point on the top of the camera. You should verify the orientation of the camera before finishing the mounting process to ensure you haven't confused the direction the camera is oriented.

Wiring

The included camera USB cable is long enough to reach most common mounting points for the controller. However, it is not uncommon for the cable to be too short if the controller and camera are mounted at opposite ends of the car. If you need to purchase additional extension cables, ensure they are high quality, and rated to handle the bandwidth and power consumption required by the cameras you intended to connect them to. Most USB 3.0 extension cables should work for this purpose, but cheap cables are often the cause of strange behavior. If you encounter unexplained video artifacts or camera connection issues, USB extension cables are generally the first place you should investigate, followed by potential power supply issues.

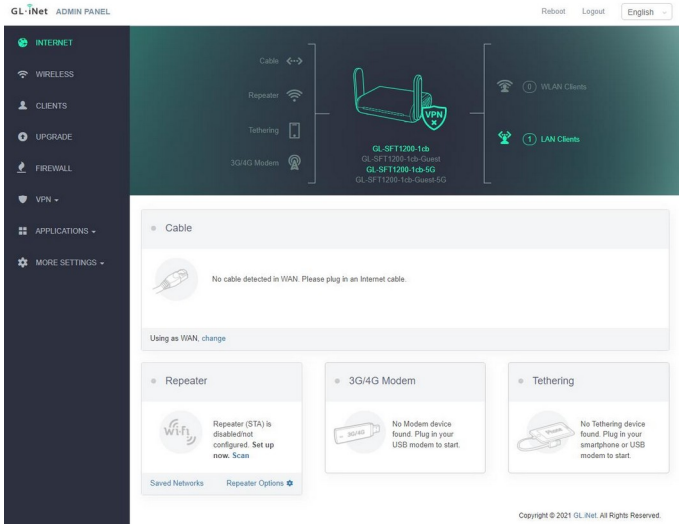
Connecting

If you purchased the “Enhanced” package or higher, you should test connectivity before you fully re-assemble the car. Once you’ve wired up all of the components in your installation kit according to the overview diagram, you can turn on auxiliary power for the car (or otherwise turn on power to the Predator system).

It may take a minute or more for the controller/router to boot up. After that time, you should be able to use a smart-phone or other WiFi enabled device to see the “V0LT Automotive” wireless network. The default password is “predator”.

After successfully connecting to the router, you can navigate to the router web interface by entering the following URL into your web browser: http://192.168.8.1/index.html

Log in to the router admin panel using the default password, “predator”. You should now see the following configuration web interface (or something similar).



At this point, you should change the default wireless network passwords and admin interface password. You may also want to tether the router to your home wireless network. To clarify, Predator does not need an internet connection to function, but it may be useful in the event that you want to update the software on the controller or synchronize the system date/time.

After configuring the router, click the “Clients” tab to determine the IP address of the controller. You should see the controller under the “Wired Device” section. Take note of the IP address. This is the address you will use to connect to your Predator controller. In the future, you should be able to simply connect to this IP address directly without needing to first open the router admin interface.

Controlling

You can now connect to your Predator control interface for the first time! These are the steps you'll follow in the future, every time you want to connect to Optic.

To begin, enter the IP address of the Predator controller (as noted earlier), followed by "/cortex". For example, you might enter "http://192.168.8.157/cortex". You should see the Optic login page. Enter the default password, "predator", to log in to the control interface.

Basic Controls

You should now see the main Cortex interface. Assuming everything is already connected and setup properly, you should see that Predator is already running in the "Control" section at the top of the page. If not, it's possible Predator ran into a problem during start-up, and was unable to automatically begin processing. Try pressing the "Start" button, and watch for any errors in the status window. See the troubleshooting section later in the manual for more information.

When license plates are detected, they should appear under the "Plates" section. Note that it may take a second or two for plates to appear after they have been detected.

Automatic Startup

By default, Predator will automatically start when the system starts. To enable or disable this functionality, click "Settings" on the main Cortex dashboard, then "Management", then "Service". Use the "Enable" and "Disable" buttons to enable and disable automatic startup.

Configuration

To configure Predator and Cortex, click the "Settings" button on the main dashboard. The "Controller Settings" page allows you to configure the Optic control interface. The "Instance Settings" page allows you to configure the Predator back-end. You can over over the name of each configuration value to see a brief description of it.

Offload Data

To download license plate data from the system, click the "Settings" button on the main dashboard, then "Management", then "Plates". The output format can be selected at the top of the page. JSON is better for most computer-readable applications (such as importing into V0LT Premonition), while CSV is generally better for human-friendly applications (like spreadsheets).

More Information

To learn more about how to use the Cortex control interface for Predator, see https://v0lttech.com/cortex.php. Documentation can be founded bundled with the software downloads, in the DOCUMENTATION.md file.

Troubleshooting

This section contains common problems you may encounter and how to resolve them.

Predator fails to start with an error message about the configured camera device not pointing to a valid file

This message occurs when the configured capture device does not exist. First, ensure the USB camera is securely connected, then restart the system.

If this doesn't resolve the issue, you may need to re-configure the capture device. Navigate to the "Instance Settings" page in Optic, and update the capture device file under the "Cameras" section. Assuming only 1 capture device is connected, the camera should be mounted at either `/dev/video0` or `/dev/video1`. Update the path, then press "Submit", and try restarting Predator to see if the issue resolves.

Note that unplugging and reconnecting the camera while the controller is booted may result in the mount point changing. As such, for sake of consistency, you should only unplug/connect the camera while the system is unpowered.

The error output in Cortex repeatedly shows a warning that the ALPR stream hasn't receive any ALPR messages in several seconds

Predator is multi-threaded, where one thread ingests data from the ALPR engine, and the main thread fetches these queued results on a regular interval (usually once per second). If the main thread doesn't receive any messages from the ALPR stream thread for several seconds, this is likely because the underlying ALPR process has failed. This issue is usually caused by a root problem in Predator, so restart Predator and watch for any messages on start up in the Cortex errors section.

Here's some common causes to check:

- The camera became disconnected during use.
- The camera device mount point is incorrectly configured (see previous topic).
- You inadvertently changed the ALPR engine setting to "OpenALPR" instead of "Phantom ALPR". Predator Scorpion comes preinstalled with Phantom ALPR, not OpenALPR.

I want to update Predator and/or Cortex to the latest version

This process is fairly technical, and prone to break things if completed incorrectly. As such, you should back up the `/home/pi/Software/Predator/` and `/var/www/html/cortex` directories on the controller before making any changes to make it easier to revert back.

First SSH into the controller over LAN, using username 'pi' and password 'predator'. It may be helpful to do this with a file manager to make copying update files easier. To update Cortex, simply download and extract the latest versions, then copy the contents into `/var/www/html/cortex`, overwriting when necessary. To update Predator, follow the instructions in the `docs/UPDATE.md` file included with the new Predator download.

I can connect to the router, but the controller doesn’t appear in the clients list

First, ensure the MicroSD card is fully seated in the controller. Next, ensure the controller is connected to the router via Ethernet, as well as connected to the included power harness. After connecting power, the red and blue lights should illuminate. At no point should the red light turn off after connecting power. After several seconds, the green light should illuminate, indicating the system is booting.

If the red light on the controller flickers or turns off, then it is likely the board is not receiving sufficient power. Ensure that the power harness is receiving a full 12V to 14.8V from the vehicle. If you have a USB volt-meter, it’s also worth checking that the USB ports on the power harness are both receiving 5.0V to 5.5V. Voltages at or below 5.0V may cause unexpected behavior.

If the previous checks pass, but the green light on the controller fails to illuminate, then the system is failing to identify the boot-loader. This is typically caused by the MicroSD card not being properly inserted. Try disconnecting power, removing the card, reinserting it, then reconnecting power. The MicroSD card is preconfigured and tested by V0LT, and you should not need to make any software modifications in order to boot the controller from it.