

# AiHomeGuard Setup

## (Ubuntu 20.04 PC and Nvidia Jetson Nano)

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Note: We also offer AiHomeGuardPro6 for Windows 10, and you may download it from <https://aihomeguard.com>, and use the same key for its activation as long as you only install one instance of the AiHomeGuard software with one license.

# 1 About AiHomeGuard Software

AiHomeGuard software does not transfer any data in your PC to any other destinations, except the alerts sent to your email recipients as you have configured with the service. AI HomeGuard LLC doesn't use this platform to send you any commercial advertisements.

AiHomeGuard built-in web server restricts the contents accessible only to the folders containing the full image and video files of detected objects. When you access the contents remotely, they are transferred using HTTP without encryption, including the user/password to login the web server. It is suggested that you use a different user/password from what you normally use. If you have a concern with exposing these contents to the Internet, then don't use the IP forwarding on your ISP router for accessing the web server over the Internet.

You can choose a hardware platform to meet your system capacity need:

1. If you only support up to 8 cameras, and you already have a PC with 6th Gen Intel, then you don't need an Nvidia GPU. This may be desirable if your PC is a laptop without a slot to add an Nvidia GPU card.
2. If you need to install more than 8 cameras, you can use a Gaming PC with an Nvidia GPU card, either a Laptop or desktop. The software performs very well on an older Gen Intel (e.g. i3-2100) under Nvidia native (cuDNN):
  - a. To support up to 12 cameras, you can buy a refurbished PC, e.g. a desktop with an i3-2100 (\$90), and add an Nvidia GT 1030 GPU card (\$80).
  - b. To support 20 or more cameras or higher camera frame rate (e.g. 10 ~ 20 FPS), you may need to add a GTX 1060.
3. The low cost option is Nvidia Jetson Nano, a \$99 single board computer with a built-in Nvidia GPU, and the hardware-accelerated H.264 (RTSP stream) decoder. The platform can support up to 5 1080p cameras if Nvidia hardware-accelerated decoder is selected during setup.
4. The above estimate assumes that you set up your camera FPS (frame rate) of 8 and resolution 1080p. If you need higher FPS, higher resolution on the cameras, or more cameras, you should add a Nvidia GPU (e.g. GTX 1050 or 1060) with 3GB or more GPU memory. The hardware-accelerated decoders on the Nvidia devices will off-load the CPU consumption on H.264 decoding. Higher FPS also enables the system to detect fast moving objects passing the monitored area and make recording more smooth.

## Release notes

- Version 6.6 (Ubuntu 20.04/PC and Nvidia Jetson Nano) has utilized Nvidia hardware-accelerated H.264 (RTSP stream) decoder, and offers higher camera frame rate (10 ~ 20 FPS), and reduces CPU consumption. Note that if you don't have a Nvidia GPU in your PC, you can still use CPU as the streaming decoder, and the Intel GPU as the AI inference engine. [Beginning with this version we no longer enhance AiHomeGuard on Ubuntu 18.04 on PC. If you want the new features offered by 6.6 or newer releases, please upgrade your Ubuntu to 20.04 on PC.](#) For Jetson Nano, Ubuntu 18.04 is offered by Nvidia JetPack with the hardware-accelerated decoder.
- Version 6.5.1 has improved the AI backend performance by 70%
- Version 6.4 has added more classes of animal and vehicle types, and the option to group different kinds of animals and vehicles into group names "animal" and "vehicle" respectively. The option can simplify the event filter setup, i.e. filtering based on either the group names or the individual classes.
- Version 6.3 has improved the user interface based on our customer feedback, It has migrated from Ubuntu 16.04 to Ubuntu 18.04 (AMD64). This version has been ported to Ubuntu 18.04 ARM64 for Nvidia Jetson Nano, and named as AiHomeGuardNano. We have made both Linux packages downloadable.
- Version 6.2 has added a web server so that you can view the full image and MP4 files streaming to your web browser with any of devices (Android, iPhone, MacBook, Windows PC, etc.). You can simply click the URL in your email alerts to view the contents without using any 3rd party app. You may also set up your ISP router with IP forwarding so that you can access your alert images and videos from the Internet.
- Version 6.1 has implemented a fine-grained event filter feature enabling you to define 7-weekdays by 24 hour time schedules with built-in actions for the core service. With this feature you can specify, like: don't issue audio and email alerts (but still keep all actions such as recording image and video) if the alert is from the "front" camera with a "person" moving "toward" the camera within the defined time schedule "nightOnly".
- Version 6.0 adopted a new AI Inference engine with a new trained AI model that offers higher accuracy with reduced latency. Compared with version 4, it has improved AI inference performance by more than 100% on native Nvidia GPU, i.e. cuDN

## 2 Prepare AiHomeGuard Installation

### 2.1 Connect PC to Home Router

You should connect your PC or Nvidia Jetson Nano device to your home router via its Ethernet port (preferable 1 Gb Wifi or Ethernet switch and ports) so that the link has enough bandwidth to receive aggregated traffic from all cameras.

### 2.2 Camera Setup

Follow the camera manufacturer's setup manual to connect them to your home router. Most IP cameras allow you to set them up using a web browser with a URL `http://camera-local-ip` (e.g. `http://192.168.1.12`). You'd better configure a static IP address for your cameras because they may reboot automatically, obtaining a different IP address from your router.

Set the frame rate and bitrate on cameras: **frame rate to 8 FPS; bitrate to 5120K**. If you have a Nvidia GPU (e.g. GTX 1050) with 3 GB or more GPU memory or run AiHomeGuard on Nvidia Jetson Nano, then the core service can utilize the hardware-accelerated decode for H.264 (RTSP stream) decoder, thus supporting higher FPS and bitrate. Higher FPS makes the recording more smooth, and can detect the fast moving objects passing the monitored areas. You can also set AiHomeGuard live streaming decoder for each individual camera with Nvidia HW decoder to off-load CPU consumption.

## 3 Install AiHomeGuard Package

### 3.1 Install AiHomeGuardPro on Ubuntu 20.04 on PC (amd64)

#### 3.1.1 Install Ubuntu 20.04 Desktop

Obtain `Ubuntu-20.04-desktop-amd64.iso` (PC with Intel/AMD CPU) from <https://ubuntu.com/download/desktop/thank-you?version=20.04.1&architecture=amd64>

You may follow the instructions to install Ubuntu on your PC:

<https://ubuntu.com/tutorials/tutorial-install-ubuntu-desktop#1-overview>.

If it is a fresh install, please create the default user account name "homeguard" with the machine name you prefer. User "homeguard" must have the home directory `/home/homeguard`. A portion of AiHomeGuardPro software and data will be installed under this directory.

**Note:** if you want to install AiHomeGuardPro on an existing Ubuntu 20.04 instance, you need to create a user account "homeguard" as the administrator (a sudo user) with its home directory `/home/homeguard`.

```

Fri Oct 2 16:49:29 2020
+-----+
| NVIDIA-SMI 450.66      Driver Version: 450.66      CUDA Version: 11.0      |
+-----+-----+-----+
| GPU  Name                Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf    Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
|====+=====+====+=====+=====+=====+=====+=====+
|  0  GeForce GTX 106...  Off      | 00000000:01:00.0 Off  |           N/A       |
| N/A  47C    P2     25W /  N/A   | 1479MiB / 6078MiB |    10%    Default  |
|                               |                      |           N/A       |
+-----+-----+-----+

+-----+
| Processes:
| GPU  GI    CI          PID  Type  Process name                      GPU Memory
|     ID  ID                                     Usage
|====+=====+=====+=====+=====+=====+=====+
|  0   N/A  N/A         1068   G   /usr/lib/xorg/Xorg                  45MiB
|  0   N/A  N/A         1701   G   /usr/lib/xorg/Xorg                  105MiB
|  0   N/A  N/A         1958   G   /usr/bin/gnome-shell                 87MiB
|  0   N/A  N/A         2645   C   ../homeguard/bin/homeguardd        1228MiB
+-----+

```

Figure 1 Nvidia GPU Driver, Runtime and Memory Usage

### 3.1.2 Install Nvidia GPU Driver

Installing an Nvidia driver is needed if you want to run AiHomeGuardPro with an Nvidia GPU. AiHomeGuard supports Nvidia GPU Pascal (e.g. GT1030, GTX 1060) and newer architectures (e.g. RTX 2060). [If you want to run AiHomeGuardPro AI Inference on a PC with 6th or higher Gen Intel CPU with an HD graphics or you just want to run it on CPU, then you may skip installing the Nvidia GPU driver.](#)

**Note:** you still need to install the Nvidia decoder and Cuda runtimes because the AiHomeGuard binary requires the runtimes to load. See the next section on installing Nvidia decoder and cuda runtime without installing the Nvidia GPU driver.

The easiest way to install an Nvidia GPU driver is to follow the instructions below:

Be sure that your PC is online, and then issue commands one by one within a terminal session. This process may take 20 ~ 40 minutes depending on your Internet download speed:

- `sudo apt update`
- `sudo apt install nvidia-driver-450` (note: the download may take 15 minutes, and then kernel modules will be rebuilt.)
- `sudo reboot` (reboot the PC).

[If nvidia-driver-450 no longer exists, you can issue a command: "ubuntu-drivers list" to get a list of available Nvidia GPU drivers. You must install a driver with its version >= 450.](#)

After rebooting the machine, verify that the nvidia driver is installed successfully with command: "`nvidia-smi`" which should show the driver and cuda runtimes versions (Figure 1).

Proceed to section 3.1.5 to install the AiHomeGuardPro package.

### 3.1.3 Install Nvidia Decoder and Cuda Runtimes

If you have installed the Nvidia driver as described in section 3.1.2, it contains the runtimes, and you can skip this section.

If you run AiHomeGuard without a Nvidia GPU (e.g. running AI inference under Intel HD graphics or CPU), you still need to install the Nvidia decoder and Cuda runtimes because the AiHomeGuard binary requires the runtimes to load.

Run the commands below from a terminal session:

- `sudo update`
- `sudo install libnvidia-decode-450-server`

If `nvidia-decode-450-server` no longer exists, you can issue a command: “`sudo apt-cache search nvidia-decode`” to get a list of available Nvidia GPU decode packages. You must install the package with its version `>= 450`.

### 3.1.4 Install Intel OpenCL Driver

If you don't use Nvidia GPU but the Intel or AMD integrated graphics (e.g. a CPU with HD graphics 530), you need to install the OpenCL driver for AiHomeGuard running AI inference. Please remember to go through section 3.5.4. Please start a terminal session, and issue commands one by one for the driver installation:

```
sudo apt update
sudo apt-get install intel-opencl-icd
sudo apt install clinfo
```

Proceed to section 3.1.5 to install the AiHomeGuardPro package.

Note: After installing AiHomeGuardPro package, you may verify that the Intel Integrated Graphics is the default OpenCL device: `clinfo`

### 3.1.5 Install AiHomeGuardPro Ubuntu 20.04 package

Enter the following commands from a terminal session:

- `wget https://aihomeguard.com/downloads/aihomeguardpro\_6.6-0\_amd64.deb` (or visit <https://aihomeguard.com> to obtain the URL for the latest version)
- `sudo apt update`
- `sudo apt install ./aihomeguardpro_6.6-0_amd64.deb`

Note: be sure that you are installing a correct package for AMD64 architecture, i.e. the package name contains “amd64” suffix instead of arm64 which is for the Nvidia Jetson Nano device.

The apt command will trigger installing some dependent packages needed for AiHomeGuardPro. Be sure that you have the PC online before installing these packages.

Once AiHomeGuardPro has been installed successfully, an icon will show on the desktop with the name “AIHG” (initially the icon has no color until you give permission to run the underlying command). Please double click that icon to invoke the AiHomeGuardPro Control

panel as shown in Figure 2. Press the button “Setup Core Service” to start the AiHomeGuard Setup process.

You may also press the “View User Manuals” button, and then watch the demo video MP4 file. The video goes through the core service setup process, including searching ONVIF cameras, drawing monitored areas, selecting and verifying AI inference backend, and so on.

**Note: The MP4 demo video can be played only when the Core Service is not running otherwise it would be blocked on the audio device being used by the Core Service.**

## 3.2 Install AiHomeGuardNano on Nvidia Jetson Nano

You need to install JetPack for Nvidia Jetson Nano by following instructions on <http://nvidia.com/JetsonNano-Start>. This OS image contains the Ubuntu 18.04, Nvidia GPU driver, Nvidia Cuda runtime, and Nvidia cuDNN runtime.

Additional requirements and recommendations are described below for the device:

1. It is recommended to have a microSD card with 128 GB capacity if you want to store alert images and recordings on that card too. Optionally, you can use an external USB drive to store the alert images and recordings, in such case a 32 GB SD card for the OS is sufficient.
2. You need a HDMI monitor or TV, a keyboard and a mouse to hook up to the device for installing the OS and AiHomeGuardNano package (see section 3.3 for accessing the device remotely).
3. Create a user “homeguard” as the default login account with a hostname you prefer. This user has the home directory “/home/homeguard”. A portion of AiHomeGuard software and data will be installed under this directory. [If you want to install AiHomeGuardNano on an existing Ubuntu 18.04 instance, you need to create user account “homeguard” as an administrator \(a sudo user\) with its home direction “/home/homeguard”.](#)

Enter the following commands from a terminal session:

- `wget https://aihomeguard.com/downloads/aihomeguardpro\_6.6-0\_arm64.deb` (or visit <https://aihomeguard.com> to obtain the URL for the latest version)
- `sudo apt update`
- `sudo apt install ./aihomeguardpro_6.6-0_arm64.deb` (or the latest package file name)

**Note: be sure that you are installing a correct package for the ARM64 architecture, i.e. the package name contains an “arm64” suffix.**

**The apt command will trigger installing some dependent packages. Be sure that you have the device online in order to install those packages.** The installation process will create a swap file which bumps up the total swap memory to 8 GB.

Once AiHomeGuardNano has been installed successfully, an icon will show on the desktop with the name “AIHG” (initially the icon has no color until you give the permission to run the

underlying command). Please double click that icon to invoke the AiHomeGuard Control panel similar to the screen in Figure 2. Press the button “Setup Core Service” to start the AiHomeGuard Setup process.

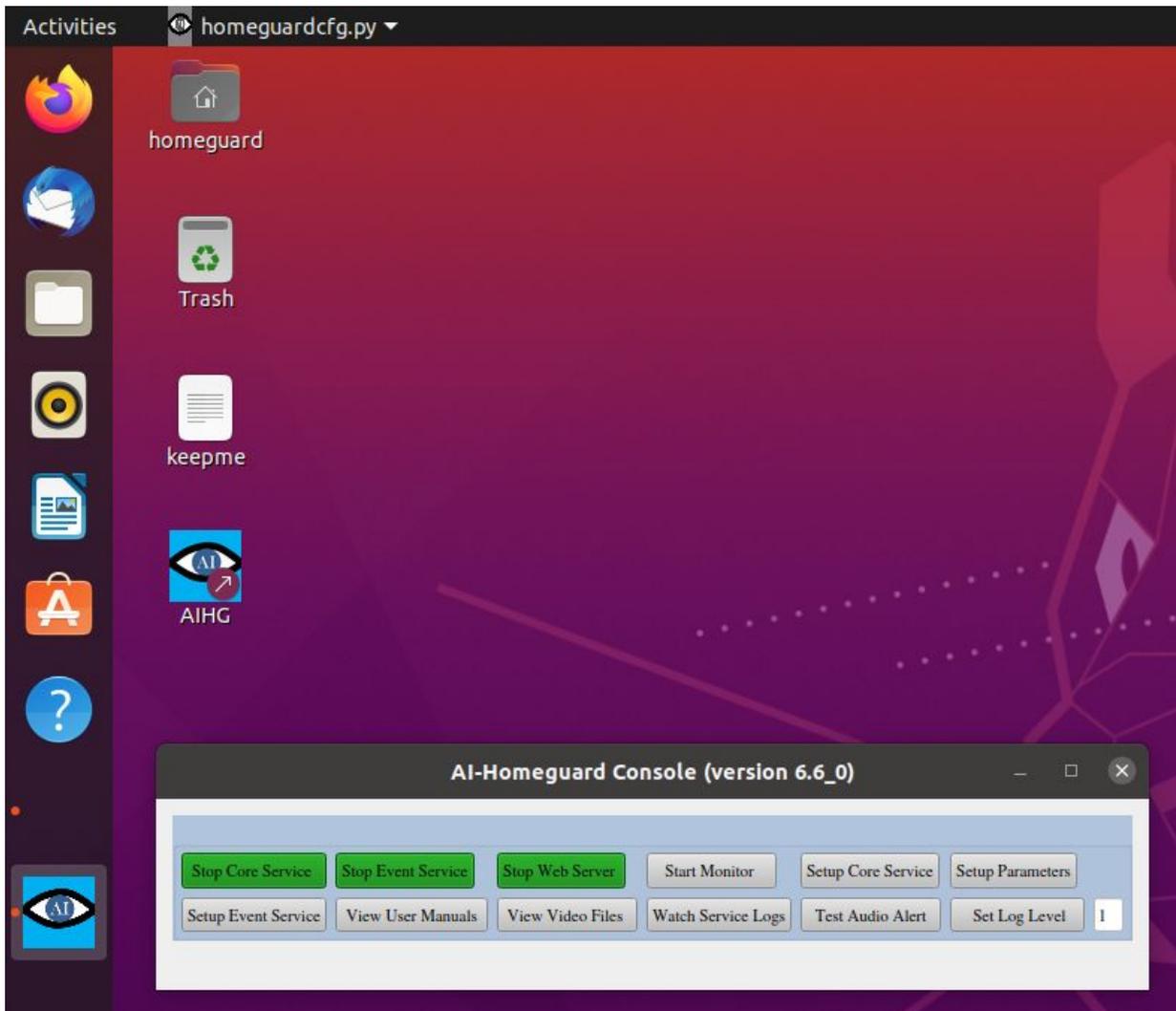


Figure 2 Ubuntu 20.04 Desktop with AiHomeGuard Control Panel

You may also press the “View User Manuals” button, and then watch the demo video MP4 file or from <https://ai-homeguard.com/documentation> (viewing local mp4 file could be blocked on the audio device by the Core Service). The video goes through the core service setup process, including searching ONVIF cameras, drawing monitored areas, selecting and verifying AI inference backend, and so on.

Tips: Once the installation has completed, you can unplug the monitor or TV, the keyboard and mouse from the device, and login into the device from another computer via ssh. See section 3.3 on how to start AiHomeGuard GUI utilities remotely.

## 3.3 Troubleshoot Installation Issues

If the AiHomeGuard control panel buttons do not work as expected (e.g. cannot start the core service), please run the commands from a terminal session to see whether there are missing dependent libraries:

- **ldd bin/homeguardd | grep not**
- If the above command shows missing libraries, be sure that you have installed Nvidia decoder runtime (section 3.1.3). This runtime is needed if you have not installed the Nvidia GPU driver because your PC has no Nvidia GPU.

If any of the control panel screens fails to show up, you may start the screen individually from a terminal session and watch any error message:

- Start Control Panel: **bin/homeguardctl.py**
- Start Core Service Setup screen: **bin/homeguardcfg.py**
- Start Core Service Parameters Setup screen: **bin/homeguardsetup.py**
- Start Core Service for debugging purpose: **bin/homeguardd (use Ctrl+C to terminate the process)**
- Start Event Service Setup screen: **bin/events\_escalate\_cfg.py**
- Watch syslog for the Core Service: **tail -f /var/log/syslog|grep homeguardd**

You may verify the AI inference backend by running the test (be sure the core service is not running when running the command):

- For Intel HD graphics: **etc/test\_ai\_backend\_intel\_gpu.sh**
- For Nvidia GPU: **etc/test\_ai\_backend\_nvidia\_gpu.sh**

You may also issue those commands remotely from a Linux machine with X-Window server, or a Windows machine with a X-Window emulator (e.g. Xming). You should use option “-X” with the ssh command for X-Window pass through if you want to use the graphic interface (GUI). Note: no X-Window server or emulator is needed if you only want to run terminal (TTY) commands.

## 4 Core Service Setup

### 4.1 Setup Cameras URL(s), Monitored Areas and Decoder

Click the “Setup Core Service” button (Figure 2) to invoke the screen (Figure 3). Press the “search cameras” button to add your cameras automatically, or you may add cameras manually by clicking on “add manually”. Note: the auto discovery feature may need a correct password in the “password” field. You can do the search multiple times if your cameras have different passwords, each time the new discovered cameras will be added to the list.

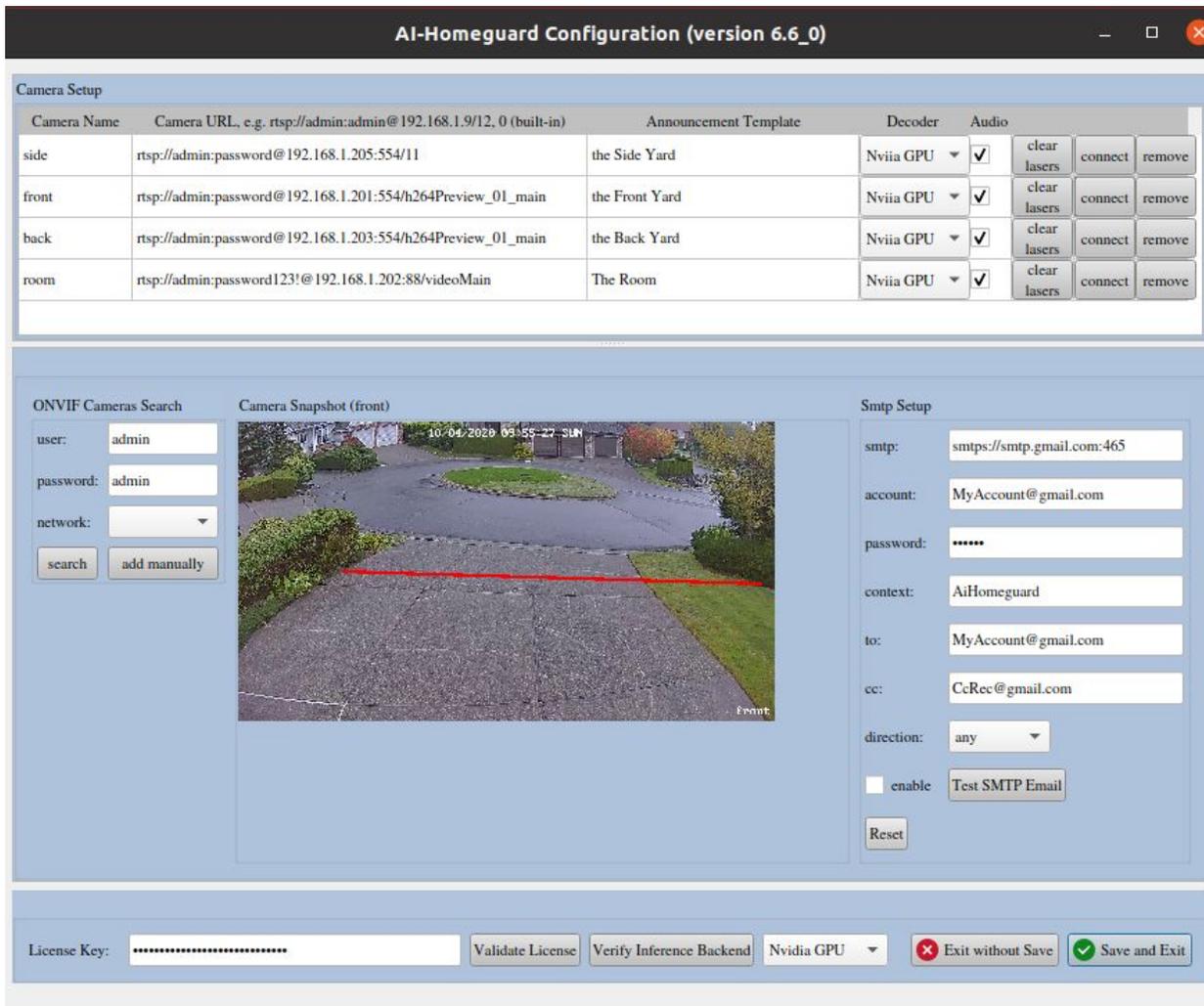


Figure 3 Core Service Setup

If your PC has multiple network interfaces, then you may need to pick an IP address from the pull-down list from which your cameras are reachable. You can initiate auto discovery on one interface at a time if your cameras are reachable from different networks/interfaces. **Some cameras might not be searchable if they don't support ONVIF protocol or ONVIF port is disabled; in such case you can add them manually; you may find the correct RTSP from <https://www.ispyconnect.com/sources.aspx>.**

Once all cameras are discovered, please change the camera names and the announcement suffixes. To set up the monitored area, click the "connect" button on that camera which will take a snapshot from its view. Draw one or more "virtual laser beams" or red lines that act like a tripwire for the area. If you want to remove a camera from the configuration, press the "remove" button. If you want to set up the monitored area at a later time without removing it, pick the "disable" option in the pull-down (decoder) list for that camera.

If your PC has a Nvidia GPU, e.g. GTX 1050 with 3 GB or more GPU memory or using Nvidia Jetson Nano, you can choose "Nvidia GPU" as the camera decoder in the pull-down list. Using an Nvidia hardware-accelerated decoder will support more cameras or higher frame

rate (FPS), and off-load the CPU consumption. Below is an estimate as how much GPU memory on PC is need for the configuration:

- The AI inference engine uses about 600 MB Nvidia GPU memory. If HD graphics is used for the inference engine, then it uses the PC's main memory for the AI inference (i.e. no Nvidia GPU memory is used for AI inference).
- Each 1080p camera uses about 160 MB GPU memory for using Nvidia GPU as the decoder.
- Starting a "Live Stream" with "Nvidia GPU" from the pull-down list (in AiHomeGuard monitor) on each 1080p camera takes about 300 MB.
- Other applications, including the Display driver, use about 250 MB.

Please use the command "nvidia-smi" to watch your GPU memory usage (Figure 1).

For Nvidia Jetson Nano, GPU uses the main memory instead of separate GPU memory, so you should monitor the main memory usage.

Tips: If there were not enough GPU memory to support all cameras (e.g. a Nvidia GT 1030 with 2GB), you could select the "Nvidia GPU" for a portion of your cameras with others using the CPU. Alternatively, if your PC is 5th Gen or newer Intel CPU(or AMD equivalent), then you can use the integrated HD graphics for the AI inference engine and leave the Nvidia GPU for the camera decoder.

## 4.2 Select AI Inference Backend

The step is to select and verify AI Inference backend before it can be used for the Core Service:

If you don't have an Nvidia GPU, but have an integrated HD graphics (e.g. a PC with 5th or newer Gen Intel CPU), select HD Graphics from the pull-down list, and press "Verify Inference Backend". It may take up to 30 to 90 seconds to validate the backend with its latency number shown in the message bar (on the bottom of the screen).

If you have an Nvidia GPU (as with a Jetson Nano device), select "Nvidia GPU" from the pull-down list, and the latency should be less than 300 ms.

If you don't have an Nvidia GPU nor a suitable HD Graphics when using a PC for AiHomeGuard, you can choose "CPU".

**Remember to press the "Save and Exit", and only the last verified inference backend will be used for Core Service.**

Recommendation: using the HD graphics (e.g. a 4th or 5th Gen Intel CPU) is preferred than using the CPU even though the latency with the CPU is lower because AI inference using CPU may compete for CPU with other tasks like camera streamings/recordings. If the

inference latency is too high, e.g. higher than 1200 ms, the delay will be longer when an object crosses the red lines triggering sending alert and recording.

You may verify that the Core Service is actually using the specified inference backend from the service log as shown in the demo video.

### 4.3 Email and SMS Notifications Setup

Follow the steps below to setup your email notification:

1. Enter your email service provider URL (a Gmail template is provided - press the “Reset” button to restore to this template), your email account name and password.
2. Enter email recipients under “to” and “cc” fields. To receive SMS/MMS alerts, you can use your carrier’s SMS/MMS gateway. For example, T-Mobile customers can send alerts to your10digitmobilenumber@tmomail.net.
3. The “Context” field allows you to enter your customized contents which will show in your email alerts, such as the web server public IP URL if you have set up IP forwarding on your ISP router (see section 5.8 for detail).
4. The “direction” pulldown list allows you to select whether or not to send email when the object is traveling toward (incoming), leave away (outgoing) or either (any) of the directions. If you select “any”, then you can configure the email sending filters based event schedule (see section 4.4).
5. Announcement Template field specifies the audio alert (using a text to speech engine) template. E.g. If the setup is “The Front Yard”, then the audio alert will be: a Person is Entering “The Front Yard” an incoming person toward the camera mounting point. You can override this pattern by specifying, e.g. “The Front Yard:Is Moving Away:Is Moving Into”, and the audio alert will be: a Person “Is Moving Into” “The Front Yard” for an outgoing person away from the camera mount point, which is meaningful if the camera is mounted on the opposite side of your house.
6. Click “Test SMTP Email” which will send a test email to your own email account. For Gmail, you need to set the “less secure apps” option to send emails (see description below); you may also need to login to your account from your other device to confirm this device. Other email service providers may have similar security measures.

#### **Enable less secure apps to access accounts for Gmail**

- A. Sign in to your Google Admin console.
- B. Click **Security** > Basic settings.
- C. Under **Less secure apps**, select Go to settings for **less secure apps**.
- D. In the subwindow, select the **Allow** users to manage their access to **less secure apps** radio button.

## 4.4 Activate AiHomeGuardPro

Enter your Activation Key you got from your purchase order. Click “Validate License”. Save the setup by pressing the “Save and Exit” button to finish the Core Service setup process.

## 4.5 Event Filter

AiHomeGuardPro provides a fine-grained event filter feature allowing you to turn off alert notifications based on the pre-configured filter conditions, which include the alert’s originating cameras, the type of object (car, person, ...), the object travel direction and a 24-hour by 7-day week matrix time schedule. For instance, you can specify that the alert will not generate “audio” and “email”, but still preserve image and video generation if that alert is originating from the “front” camera with object “person” or “car”, and is crossing the red line with “incoming” direction, and when the event occur on “week day hour only” (e.g. Monday to Friday between 8 a.m. to 6 p.m.).

You can create multiple such time schedules, event filters, actions for different scenarios, and the filter and schedule will be evaluated by the Core Service process.

You may watch the “EventSetupDemo” video on how to configure the event schedule, filter and actions, or read section 8 for the detailed description of this feature.

# 5 Start, Stop Services and Monitor AiHomeGuard Alerts

## 5.1 AiHomeGuard Monitor

Click the “Start Monitor” button (Figure 2) to invoke the monitor screen (Figure 4). From the monitor, start live streams from cameras, temporarily disable (hibernate) any cameras for a period of time, navigate the view of the detected objects, and play the associated recording.

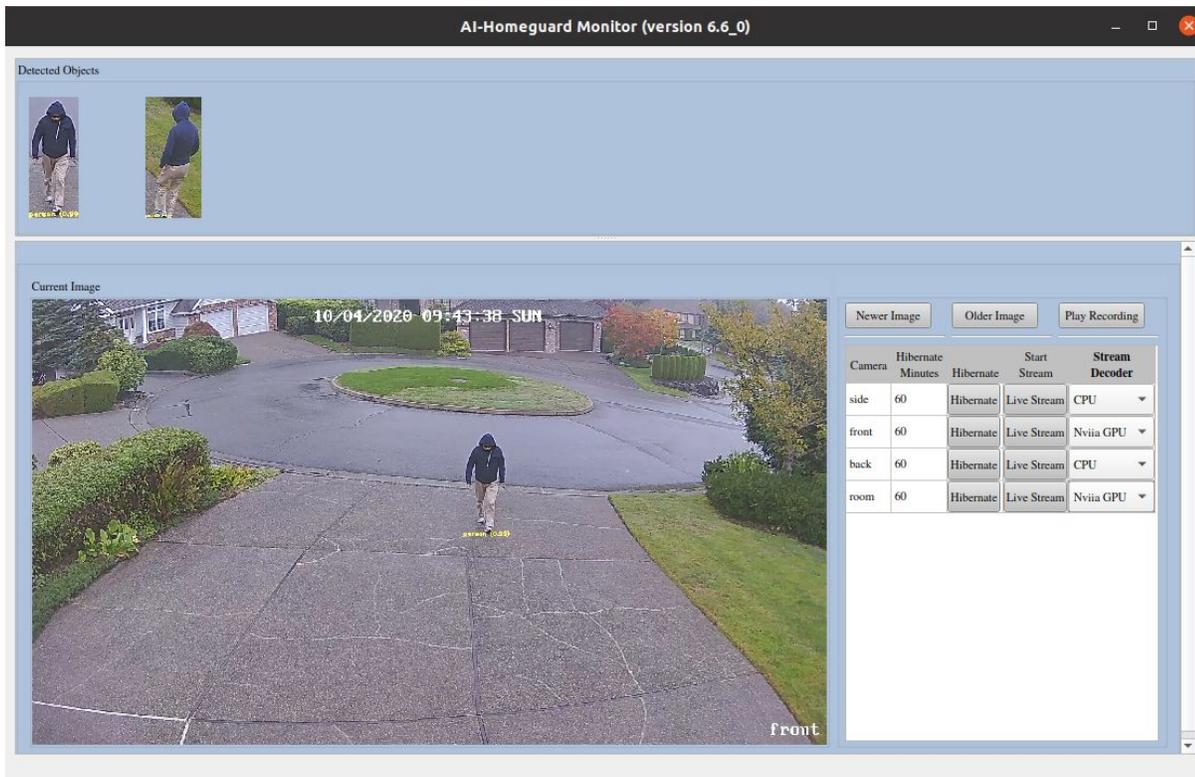


Figure 4 AI-HomeGuard Monitor

## 5.2 Start Core Service

Click the “Start Core Service” on the control bar screen. Once the service starts successfully, the AiHomeGuard button “Core Service On” will turn to green. **Note: the image section on the monitor screen will remain blank until the system detects its first object.** Core Service will be notified for most of the changes you made on the core setup screen and reload the new values. Please follow the screen prompt when you save your changes as to whether you need to restart the Core Service. Note that once the services start, it will automatically start when the OS reboots (e.g. after a power loss) no matter whether the monitor is shown or not. **Note: to ensure auto power on works, you may need to connect the device with Ethernet instead of WiFi so that the network is up before you log on to account “homeguard”.**

## 5.3 Viewing Images and Video Clips

Thumbnails of detected objects are at the top, with the leftmost being the most recent event. To view the full image, click on a thumbnail. Scroll through your images by clicking “Older image” and “Newer image” for those not shown in the thumbnails.

Click the “Play Recording” button to watch the video clip associated with the full image.

Your email alert also contains a link to a web page (HTTP port 8000) where you can view the full images and watch the recordings from a browser with your device (iPhone, iPad, Android devices, Windows) as long as they are on the same LAN (or WiFi router) as AI-HomeGuard

server, or you can access the contents over the Internet with IP forwarding on your ISP router (see section 5.8 for the detail).

## 5.4 Temporarily Disable Object Delections on Cameras

You can temporarily disable (hibernate) the detection function on any cameras from the monitor screen. Next to the desired camera, enter the number of minutes you want to disable and click “Hibernate.” To resume the hibernation, use the value “0.”

## 5.5 Live Streaming from Cameras

Press the “Live Stream” button to get a live stream screen for those cameras. Starting streaming from cameras may cause your PC consuming more CPU, and may reduce the total number of cameras the system can support. Please watch your CPU utilization to decide if the CPU is overloaded.

If your PC has installed a Nvidia GPU, you may use the GPU for the camera live streaming (choose Nvidia GPU in the pull-down list) which will significantly reduce the CPU consumption. [Use the “nvidia-smi” command to watch the GPU memory usage \(Figure 1\).](#)

## 5.6 Service Log

You can monitor the core service and event service logs by clicking the “View Services Log” on the control panel, or issue a command from a terminal session: “tail -f /var/log/syslog|grep homeguardd”. If you need any customer support, please provide the service log messages to help diagnose the problem. You may set up log level (0 ~ 6) by pressing the “Syslog Verbose” on the control panel with the desired log level number.

## 5.7 Start Event Service

Clicking the “Start Event Service” from the control panel, and the status on the control panel for the service will turn to green. You must have set up the Event Service before attempting to start the service. Please see section 4.5 and 8 for Even Service setup.

## 5.8 Start Web Server

Click the “Start Web Server” from the control panel, and the button on the panel for the service will turn to green.

AiHomeGuard Web Server (on port 8000) allows you to access the alert images and video recordings simply by clicking the URL in the email alerts or type the URL on your remote device’s web browser, e.g. <http://pc-private-ip:8000>. You can access the contents from a mobile device (Android or iPhone), or a desktop computer (Windows PC or MacBook).

You may also access the contents (full images and videos) over the Internet if you have set up the IP port forwarding for AiHomeGuard web server with port 8000 on your ISP router.

Please read your ISP router manual or Google “IP port forwarding” for your ISP router brand/model. If you want to reach the web server with one-click on your email alerts, you can set the “context” field on your SMTP setup (on Core Service Setup screen) with URL, e.g. <http://your-public-ip:8000>. To find out what your public IP address is, simply search Google with “what is my ip address” from the PC’s browser.

The default setting for AiHomeGuard web server is HTTP with access permission on two folders: the images folder and the video files folder. If you want to have the web server being accessed with user/password protection, you need to edit file, e.g. “nano /lib/systemd/system/http-server.service” and add two additional parameters (--username your-username --password your-password”) to line:

```
“ExecStart=/usr/bin/node /usr/local/lib/node_modules/http-server/bin/http-server -p 8000 -s”
```

You need to stop and then restart the web server when you change this file.

**Note: If you upgrade from an older version to version 6.2.0 when using a PC for AiHomeGuardPro, you need to shutdown and restart the PC otherwise the web server may fail to start.**

## 6 AiHomeGuardPro Software Upgrade

You may check <https://aihomeguard.com> for any new package for Linux or Nvidia Jetson Nano (Ubuntu 18.04). You can only manually upgrade by first downloading the Debian package with higher release number than your current version, remove the old AiHomeGuardPro package with command: “sudo dpkg -r aihomeguardpro”, and then install the new Debian package as described in section 3.1.

To prevent loss of your configuration and alert images and recordings, make a backup of your files /home/homeguard/cfg/\*.cfg, /local/data (which is referenced by a symbolic link from /home/homeguard/data) before removing the old “aihomeguradpro” package.

## 7 Core Service Parameters Adjustment

### 7.1 About Core Service Parameters

The default core service parameters are sufficient for most all deployment scenarios. However, if you want to fine tune the system behavior, such as increase or reduce motion sensitivity or choose to ignore some particular objects (e.g. cat, dog), you may run “Setup Parameters” on the control panel to invoke the Core Service parameter setup screen (Figure 5). Press the label with question mark (“?”) button for the description on each parameter. Press the “Save/Exit” button to save the changes. The Core Service will be notified and refreshed with the parameters you have changed.

AiHomeGuardPro objects can be classified as the original object (opt-in), mapped to group name (e.g. “animal” or “vehicle”), or to be ignored (opt-out) for detection. Classifying one or more objects (e.g. bird and cat) onto an known name (e.g. animal) can simplify the event filter

setup (see section 8.2 for event service setup), and reduce the chance of missed detections. For instance, a dog might be recognized as a cat by the AI engine when the frames were taken by a camera under poor light conditions especially when the camera’s shutter speed is low for capturing fast moving objects.

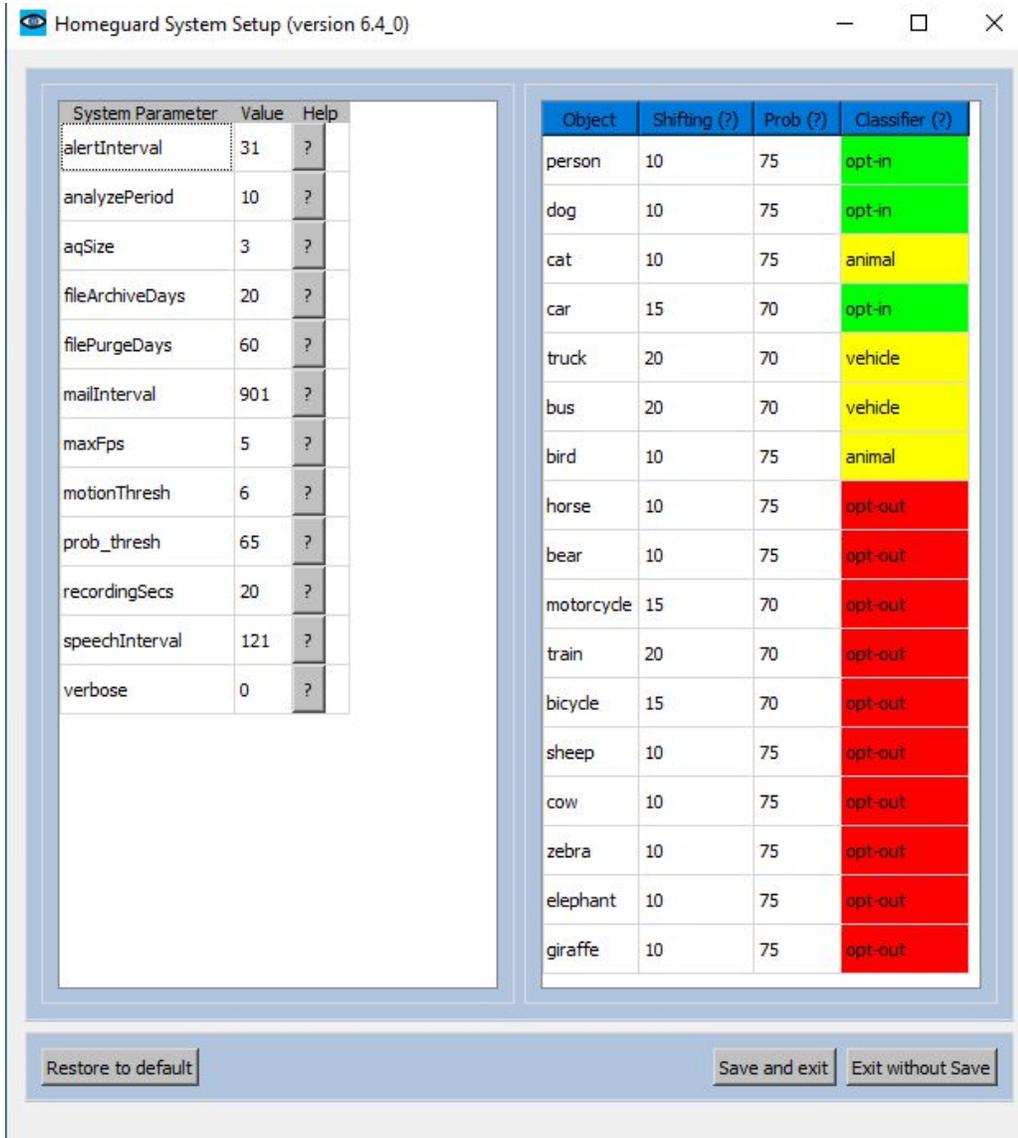


Figure 5. Core Service Parameters

## 7.2 Set Archive and Purge Image and Video Files

A Linux cron job will archive and purge old image and video files automatically with default 20 days for archiving and 60 for purging at 1 a.m every day. If you want to change the values, please change the parameters on the “Setup Parameter” screen.

# 8 Event Service

## 8.1 Event Service Overview

AI-HomeGuardPro offers an Event service, which can control:

1. Filtered alerts emitted from the Core Service. For instance you want Email and Audio alerts to turn off if they are originating from the “front” camera for object “cat” or “dog” during “daytime” specified by a time schedule matrix. The filter is evaluated by the Core Service once you save the setup without the need to restart the Core Service.
2. Smart switches or plugs when the AI engine has detected an object entering or leaving your area. With this capability you can add additional protection on your home area. For instance, you can plug a siren to the smart plug and configure the service to trigger the siren, for example, when the “front” camera detected a “incoming” “person” on “normal” schedule, and turn on smart plug “FrontSiren” for 30 seconds. The smart switch actions are evaluated by the event service process and require that service to run.

## 8.2 Event Service Setup for Core Service

You may watch the demo video “EventSetupDemo” in the “User Manual” folder from AiHomeGuardPro Console bar, or follow the steps described below.

As the basic rules, all alerts will be delivered by default if you don’t set any Event Service filters or schedules. The alert actions, currently including “emailOff”, “audioOff” or “alertOff”, can be taken to ignore the alert if it matches the defined filter condition with the specified time schedule.

Select “Setup Event Service” from the control panel. The event setup screen will appear (Figure 6). The figure demonstrates a time schedule created for daytime hours during the week, and a referencing event filter called “roomDayOff”. The filter conditions and the associated actions specify that when the alert is originating from the “family room” camera, and any of “person”, “dog” or “animal” is crossing the red lines in any direction, then actions “AlertsOff@CoreService” will be invoked by the Core Service, meaning alert will be filtered out during schedule “dayHours” (i.e. alerts will be emitted during midnight only).

To create a new schedule, just press the “Add Schedule” button. To create a new event filter, press the “Add Event” button, and then select the conditions, objects and time schedule from the pulldown lists. To add an action for that event filter, select one (e.g. AudioOff@CoreService) from the Action pulldown list, and then right-click the mouse button to add that action into the action table.

There is no need to restart the Core Service when you save your changes, and the Core Service will be notified and reload the event configuration.

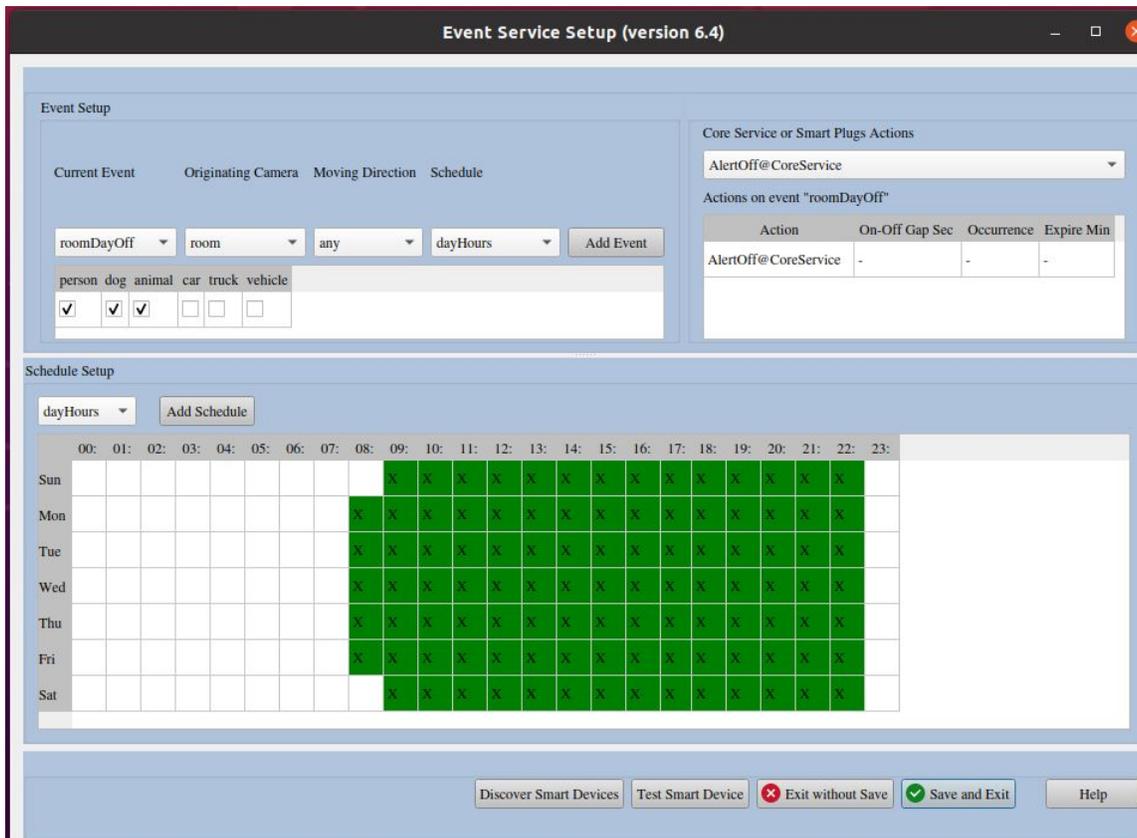


Figure 6 Event Service Setup

## 8.3 Event Service Setup for Smart Switches

Click “Setup Event Service” from the control panel. The event setup screen (as shown in Figure 7) will appear. Please follow the steps below to create schedules, filters and actions:

1. First, you need to discover all smart plugs or switches on your WiFi network. You may try more times if you don't see the plugs you expected.
2. The system provides a default schedule when you first run the configuration. You may add more schedules for filters (on escalation setup).
3. Click the square to turn on or off that hour for the day of that week.
4. If you want to delete an unused schedule, select it from the pulldown menu, and then right click the mouse..
5. Press the “Add Event” button to create a new event filter. Then choose other conditions in the filters (camera, object, moving direction, and schedule)
6. If you want to delete an event filter, select it from the pulldown menu, and right-click the mouse button.
7. Select a smart plug or switch discovered at step 1, and right click the mouse to add it to the action. You may set three values: the interval to turn on or off the switch (in seconds), the total number of On or Off to take; note that an even number will eventually put the switch at Off state, and odd number will put it at On state finally, and the expiration (minutes) is for prohibiting other actions to control the same switch within that period.

8. If you want to remove a switch from an action, right-click the mouse button at the switch name on the action table column.

Once you complete the configuration, remember to press the “Save and Exit” button to make the change effective, the Event service process will automatically refresh the changes.

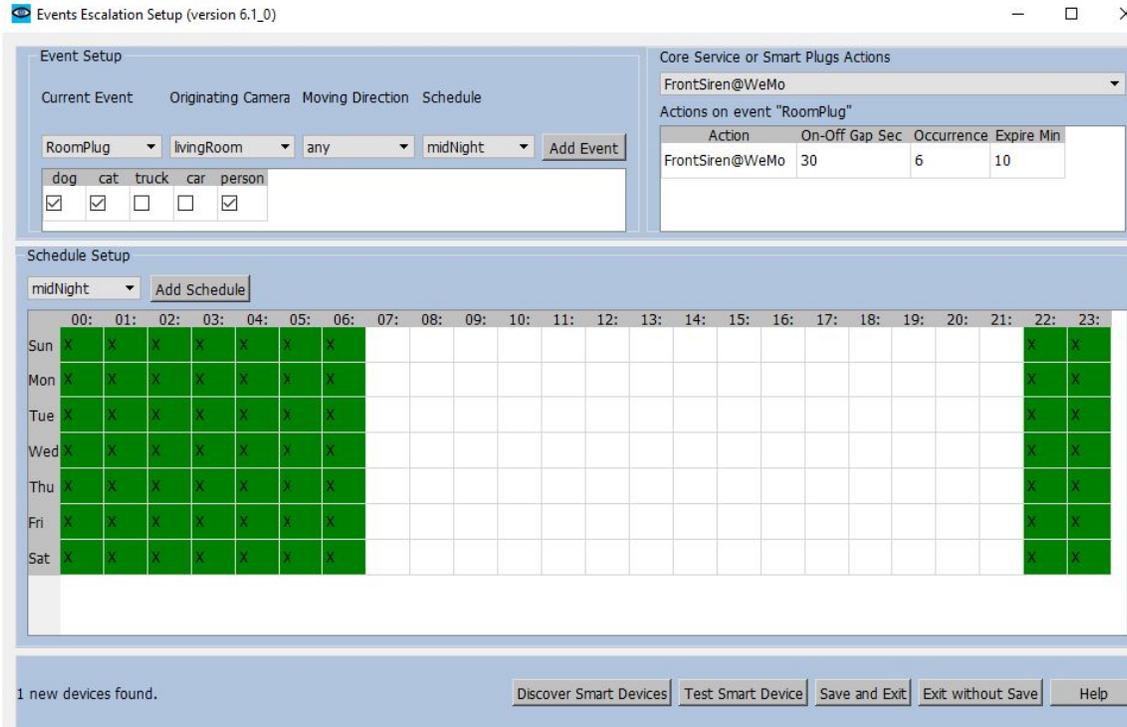


Figure 7 Smart Switch Event Schedule

## 8.4 Event Service Process

For the smart switch related filters, schedules and actions, you need to start the Event Service Process by clicking the “Start Event Service” from the control panel (Figure 2). There is no need to restart the Event Service Process when you change the event setup, and the Event Service Process will be notified and reload the event configuration. Once the service is started, it will automatically start after the OS boot (e.g. after a power outage).

## 8.5 Event Notification API

AiHomeGuard has not integrated its capability into some popular home apps, such as Google Home or Amazon Alexa. However, AI-HomeGuard provides an API allowing users to add their own programs to handle events on the detected objects. The events are instantly delivered to the event consumers which can determine which kind of object is detected. The events are sent by AI-HomeGugard core service to a multicast UDP port (43210) on the loopback network interface with multicast group address 226.1.1.100. The events are ASCII strings with the following fields:

- notify image image-base-name

- notify video video-file-name (once the recording completes).

The application that received the messages can parse the “image-base-name” to get the information about the detected object:

- The type of object (car, person, dog, etc.)
- The camera name which detected the object
- The time at which the object is detected, including year, month, hour, minute, second, and millisecond
- The direction the object is moving (either toward the camera or move away from the camera) From the base image name, the user application can derive either the full or cropped images file path.

You may read the Python source code “AiHomeGuardProEventConsumerSample.py.txt” under directory “docs” as how to receive event notifications.

In addition to receiving notifications from the core service, you may write your application to send simple commands to the core service via the named pipe, e.g. hibernating a camera for a period of time, as shown in the Python script bin/homeguardctl.py.

## 9 Troubleshoot

If you invoke an action from any AiHomeGuardPro GUI utilities via control panel (setup screens, monitor, etc.) but failed, or the screen session crashed, you can try to invoke the GUI utility from an command line and get more clue why it has failed (e.g. missing dependent packages due to incomplete software installation). Please refer to section 3.3 in detail.

### 9.1 Cannot Connect to Camera from “Setup Core Service” Screen

If a camera’s view is not shown after you press the “connect” button, follow the steps below to troubleshoot:

Start a “xterm” session, and ping camera’s IP address (e.g. ping 192.168.1.201). If the ping fails, check the camera setup again using your camera’s manufacturer’s app to find its correct IP address. If the ping is successful, ensure that you are using a correct RTSP or MJPEG URL. If you get the URL manually (e.g. ONVIF discovery is disabled on cameras), you may find the correct RTSP or MJPEG URL from the commonly used cameras list in Appendix of this document, from your camera’s manufacturer’s home page, or from iSpy site <https://www.ispyconnect.com/sources.aspx>.

Also, double check that you typed in a correct user/password within that URL. You may need to check if the camera is configured with a standard RTSP (554) or MJPEG port.

Sometimes, a camera can stop working because most it reboots at midnight, and obtains a new IP address from your router. It is advised to set up a static IP address on each of your cameras.

### 9.3 Fail to Start Core Service

When you click “Start Core Service” from the control panel, the button should turn to Green; the Core Service may fail to start if there is no camera configured. To find out the root cause, please check the services log (via the control panel or check file `/var/log/syslog`) or start the command manually (sesion 3.3).

### 9.4 The Core Service Failed to Open Camera

If your PC has an Nvidia GPU installed, and you select “Nvidia GPU” as the decoder, connecting to the camera may fail if there is not enough GPU memory. Please watch `/var/log/syslog` for such errors or use the command “`nvidia-smi`” for the GPU memory usage.

### 9,5 The Core Service Failed to Detect Objects

If your PC has an Nvidia GPU installed, If you select “Nvidia GPU” as the AI inference engine, the inference operation may fail if there is not enough GPU memory. Please watch `/var/log/syslog` for such errors or use the command “`nvidia-smi`” for the GPU memory usage.

### 9.6 Fail to Detect Moving Objects

Make sure that your RTSP connection has good quality. On the AI-HomeGuard monitor screen, click the “start stream” button for that camera, and you should see a new window showing real-time video stream for that camera. Be sure that the video quality is good (constantly clear view). If you observed damaged image frames, recheck the camera setup (section 2) for the correct frame rate and bitrate. The bit rate doesn't need to exceed 6144 Kbps, and the frame rate doesn't need to exceed 10 frames per second, your network bandwidth may not be able to support the aggregated rates of your cameras, or you may have to use a higher end router. A basic test of the link quality is to keep a stream window open for an hour, and see if it quits by itself (it would quit if there were consecutive 10 missing frames). The poor link will cause repeatedly close/reopen the camera at the Core Service, and may cause missed detections.

If you still see damaged images, check your WiFi connection quality. You may need a WiFi extender if the WiFi signal is too weak at the camera's installed location.

If none of the above are the root cause, set a higher log level, e.g. 6 (via Services Monitor), and then press “View Services Log” on the control panel. You need to walk to the front view of a camera, and then check the logs and see if there is any clue.

Note: the system will not send alerts on duplicate detections. An alert (email, audio or image shown on the monitor) is considered duplicate if the same camera discovers the same type of object (person, car, etc.) traveling in the same direction within a predefined period, e.g. three minutes for sending email, which can be modified with “Setup Parameters” screen.

## 9.7 False Alarms Observed

- If the alarm is triggered by a stationary object (e.g. a poster containing a human picture or a parked car) you may increase parameter value “aqSize” (invoke the screen by clicking the control panel “Setup Parameters” button), to 3 or 4 (the default is 2). This parameter is used to analyze the motion of a sequence of identified objects so that a stationary object wouldn't trigger an alarm. Note that the larger value of aqSize may increase the response time: it roughly equals that value times the Inference latency - you can see the latency from “Verify Inference Backend” in the setup screen. The response time is when the object crosses the red lines until an alert is generated, and the video recording is started. You may also increase the value of parameter “shifting” for that object (e.g. for parked car or truck). This parameter specifies the minimum movement the object has moved before an alert can be triggered. The value is measured as the percentage of detected object width.
- If a moving object is mistakenly classified, e.g. take moving shadow as a person - this may occur if the lens of the camera got wet during the night, and get reflections from the infrared light on the camera, you may increase the aqSize described above or increase “prob\_thresh” for that object.

## 9.8 Fail to discover smart switches or plugs by Event Config or Service

- Please press the “Discover Smart Devices” button a few times and see if it can discover more devices (during “Setup Event Service” session).
- Be sure that the switches can be discovered by the manufacturer's apps.
- Also check the WiFi connection quality of those smart switches.

## 9.9 Fail to turn on smart switches by Event Service

Please run Event Configure, and press the “Discover Smart Devices” button. Once the switches are shown, press the “Test Smart Device” button to see if you can turn it on or off. The problem may be caused by Event Service. Please check the syslog for conditions, schedules or unmatched actions. Be sure that the PC clock is correct, otherwise you may wrongly configured the schedules.

If your system has tried to rediscover the smart switches after it failed to contact the switch (e.g. the switch has changed its IP address after reboot), then the system should resume to work for the next detection.

## 9.10 Failed to Send Test Email in Setup Core Service

These tips are for using your Gmail account to send alerts. Other email service providers might have other Smtplib URLs for sending email.

If you got an “Authentication Failed” error when pressing the “Test SMTP Email” button on the “AI-HomeGuard Configure” screen, please follow the instructions described in section 4.3 of this document. If you get an error other than “Authentication Failed” when pressing the “Test SMTP Email”, you might have entered invalid (or removed) some needed text in the fields (e.g. in field SMTP). Note that no character “;” in any field is allowed. You may restore the default values by pressing the “Reset” button on the “SMTP Setup” panel, and replace the default values one by one before pressing the “Test SMTP Email” to see which field caused trouble.

## Appendix

### A1 Commonly Used IP Cameras Supporting RTSP/MJPEG

If your cameras don't support ONVIF but support RTSP, you may search them on <https://www.ispyconnect.com/sources.aspx> and find out the RTSP or MJPEG URL(s) for your camera brand/model. Here is a list of low-cost wireless cameras. The high-end or wired cameras with the same brands should be working too as long as they support RTSP (H.264) or MJPEG.

- Foscam Outdoor Bullet Camera, RTSP URI: `rtsp://admin:pwd@ip-addr/videoMain`
- Wansview RTSP URI: `rtsp://admin:pwd@192.168.1.7/live/ch0`
- Amcrest RTSP URI: `rtsp://admin:pwd@ip-addr/cam/realmonitor?channel=1&subtype=0`
- Reolink RLC-410 RTSP URI: `rtsp://admin:pwd@ip-address/h264Preview_01_main`
- Microseven RTSP URI: `rtsp://admin:pwd@ip-address/11`
- SV3C RTSP URI: `rtsp://admin:pwd@ip-address/11`
- Mobotix MJPEG URI: `http://admin:pwd@ip:port/control/faststream.jpg?stream=full`
- Zmodo (most models), RTSP URI: `rtsp://admin:pwd@ip-address/tcp/av0_1`
- Lorex RTSP URI:  
`rtsp://admin:pwd@<camera-ip>:554/cam/realmonitor?channel=1&subtype=0`

If your camera brand/model is not listed above, you can visit <https://www.ispyconnect.com/sources.aspx> and search for your camera brand/model for RTSP or MJPEG URL(s).