

# Can you recombine the data from a thermal camera using a computer

+ New

1h

...



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## Sources

3D Radiometric Mapping by Means of LiDAR SLAM and Thermal ...

[PDF] Transforming Thermal Images to Visible Spectrum ... - DiVA portal

What is the conventional way ...

mdpi

diva-portal

reddit

## Answer

No, it is not possible to directly recombine data from a thermal camera to get a normal visible light image. Thermal cameras and visible light cameras capture fundamentally different types of information <sup>1</sup> <sup>2</sup>.

Thermal cameras detect infrared radiation emitted by objects based on their temperature, while visible light cameras capture reflected light in the visible spectrum. As a result, the information contained in thermal images does not directly correspond to visible light images <sup>2</sup>.

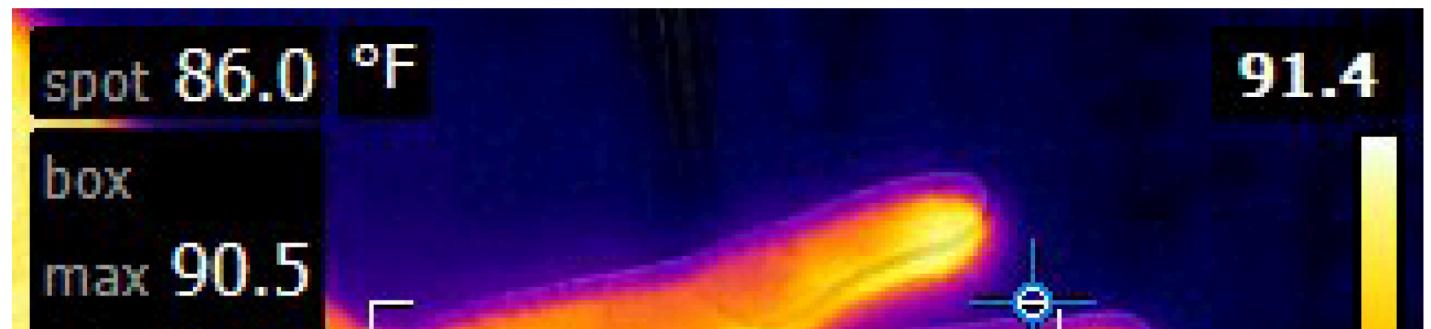
However, there are techniques to transform or enhance thermal images to make them more visually interpretable:

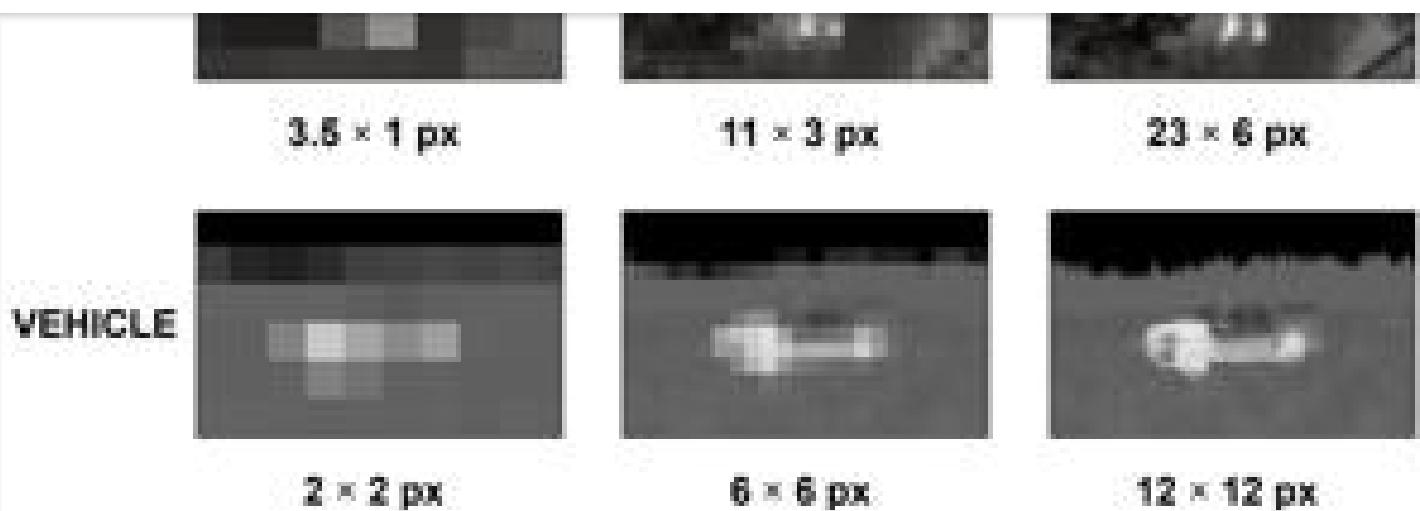
1. Colorization: Thermal data can be mapped to a color palette to create false-color images that are easier for humans to interpret <sup>3</sup>.
2. Image fusion: Thermal images can be combined with visible light images to create composite images that show both thermal and visual information <sup>8</sup>.
3. Machine learning approaches: Deep learning models can be trained to generate synthetic visible-like images from thermal input, though these are estimations rather than true visible light images <sup>5</sup> <sup>7</sup>.

These methods can make thermal data more visually accessible, but they do not recover the actual visible light information that was not captured by the thermal camera in the first place.

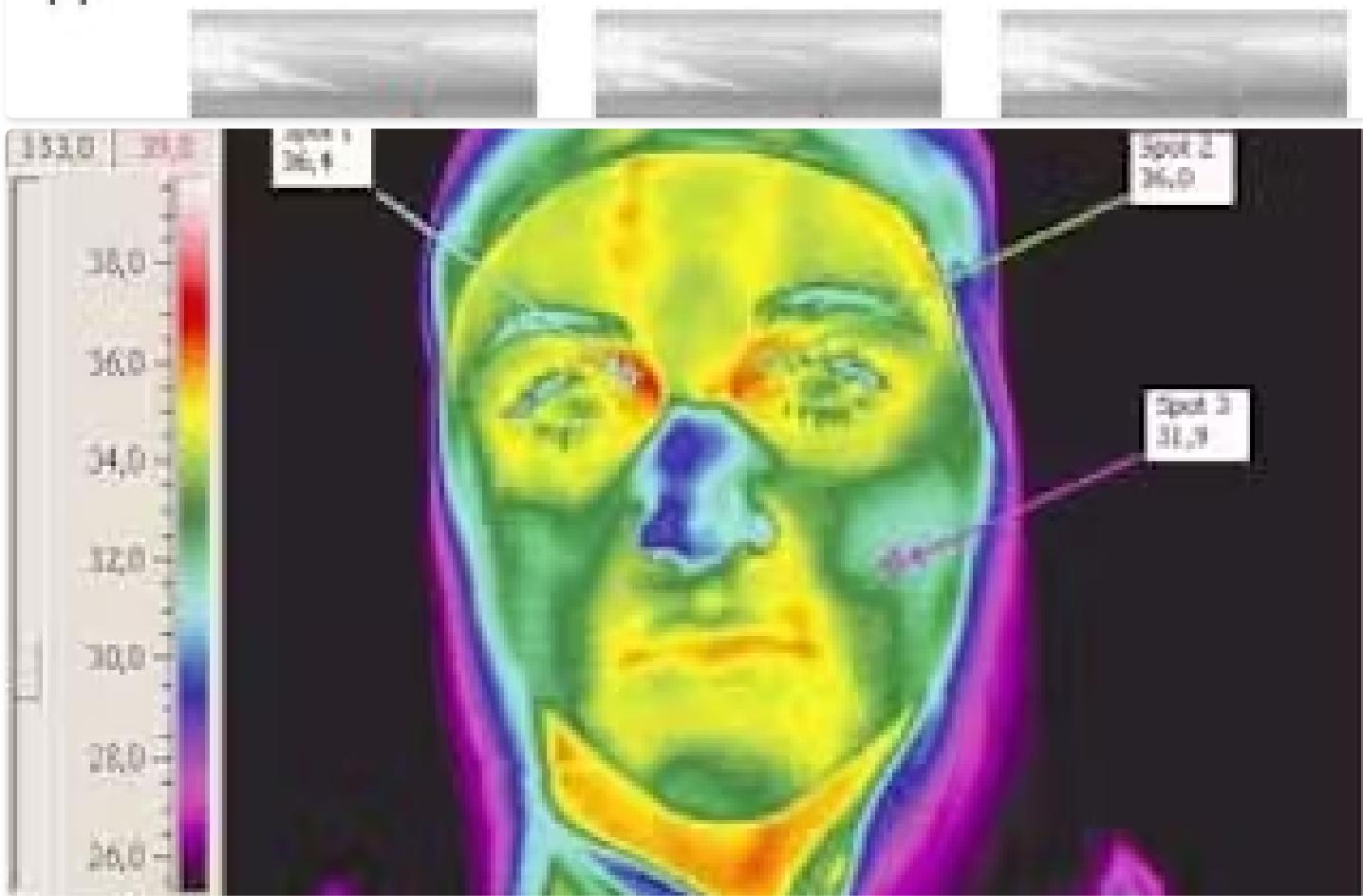
Share Rewrite

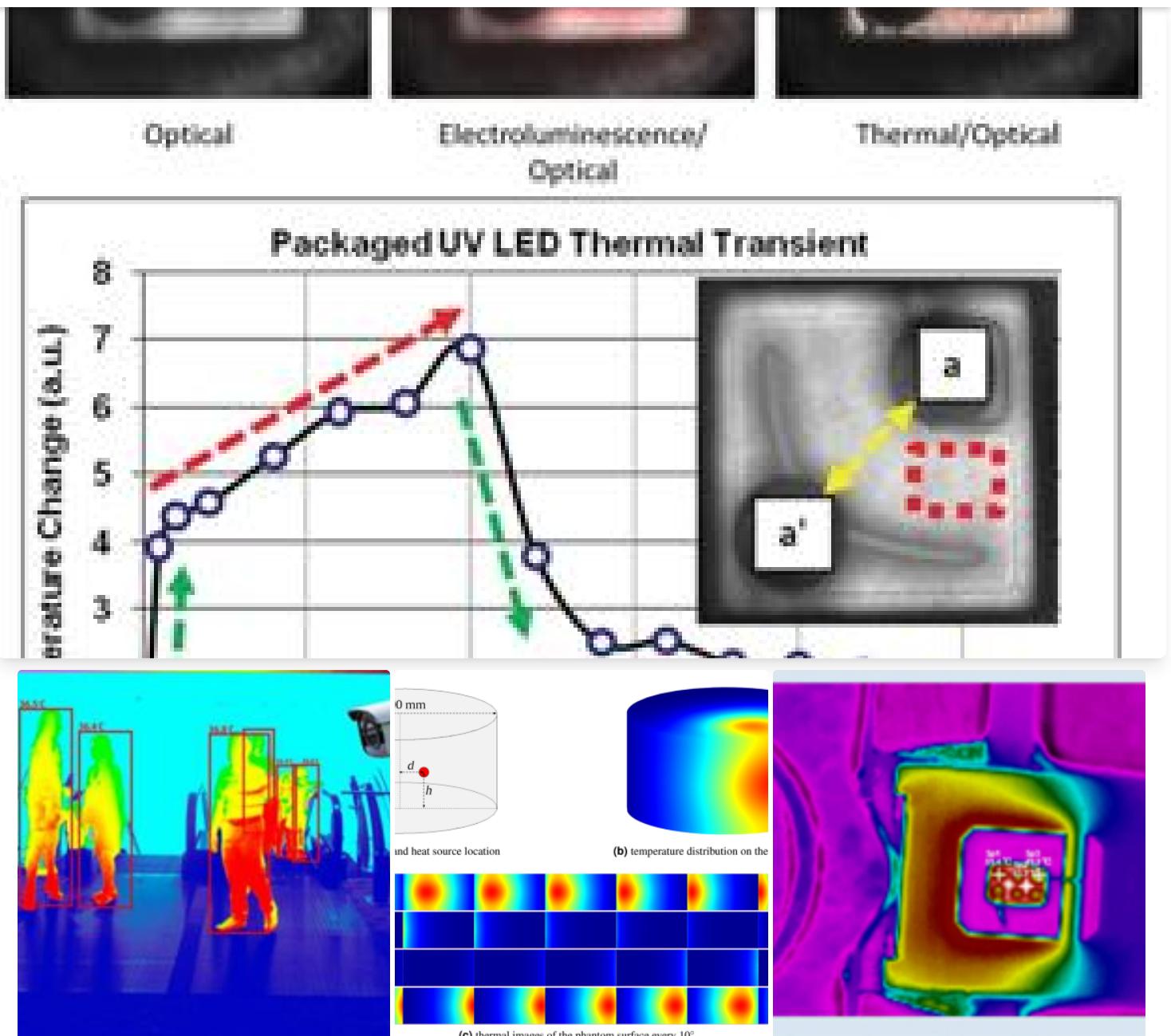
Like Reply Edit ...





(b)





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Do thermal cameras sometimes also have a regular light sensor inside as well?

## Sources

## Answer

Yes, many thermal cameras incorporate both thermal and visible light sensors in a single device <sup>1 6 8</sup>. These dual-sensor systems combine the strengths of thermal imaging with traditional visible light cameras to provide a more comprehensive surveillance or imaging solution.

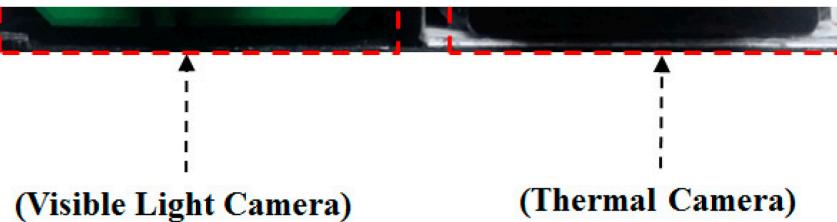
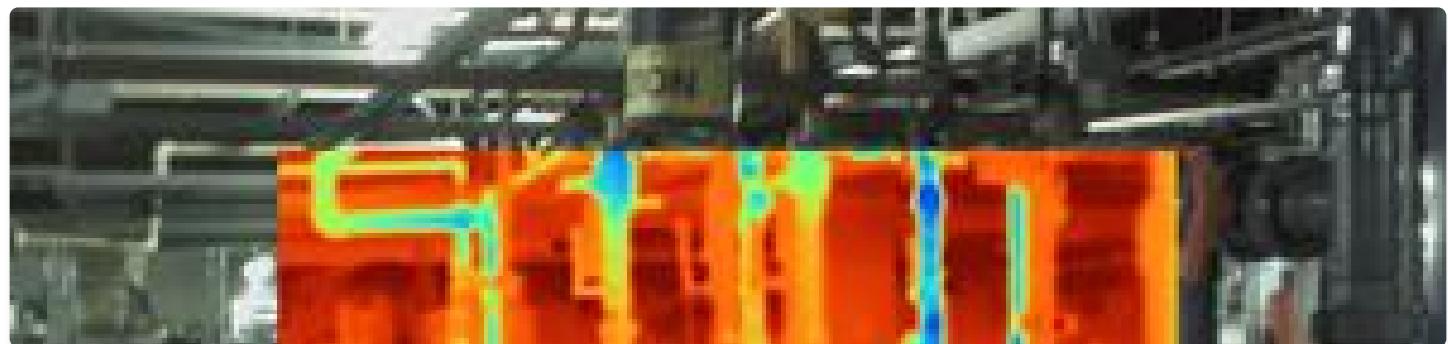
Key features of these dual-sensor thermal cameras include:

1. Simultaneous capture: They can capture both thermal and visible light images at the same time <sup>5</sup>.
2. Image fusion: Some systems allow blending or overlaying of thermal and visible images for enhanced interpretation <sup>7</sup>.
3. Flexible viewing options: Users can often switch between thermal, visible, or combined views <sup>2</sup>.
4. Complementary strengths: Thermal sensors excel in low-light conditions and can detect heat signatures, while visible cameras provide detailed color imagery and familiar visual references <sup>3</sup>.
5. Enhanced detection and identification: The combination of sensors improves the ability to detect, locate, and identify objects or individuals in various environmental conditions <sup>6</sup>.

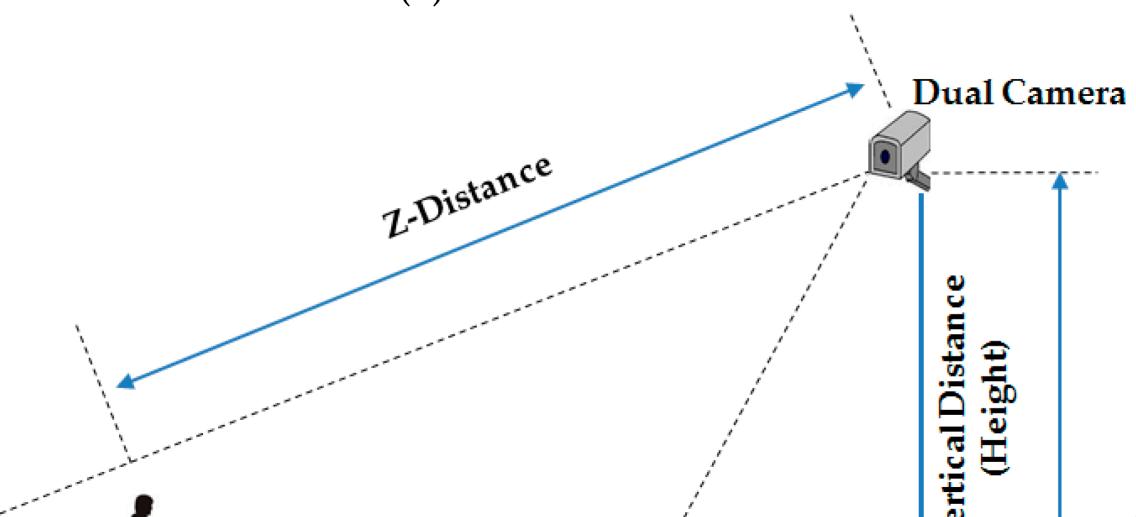
These dual-sensor thermal cameras find applications in security, surveillance, maritime use, and industrial inspections, offering versatility and improved performance across different lighting and weather conditions <sup>9 10 11</sup>.

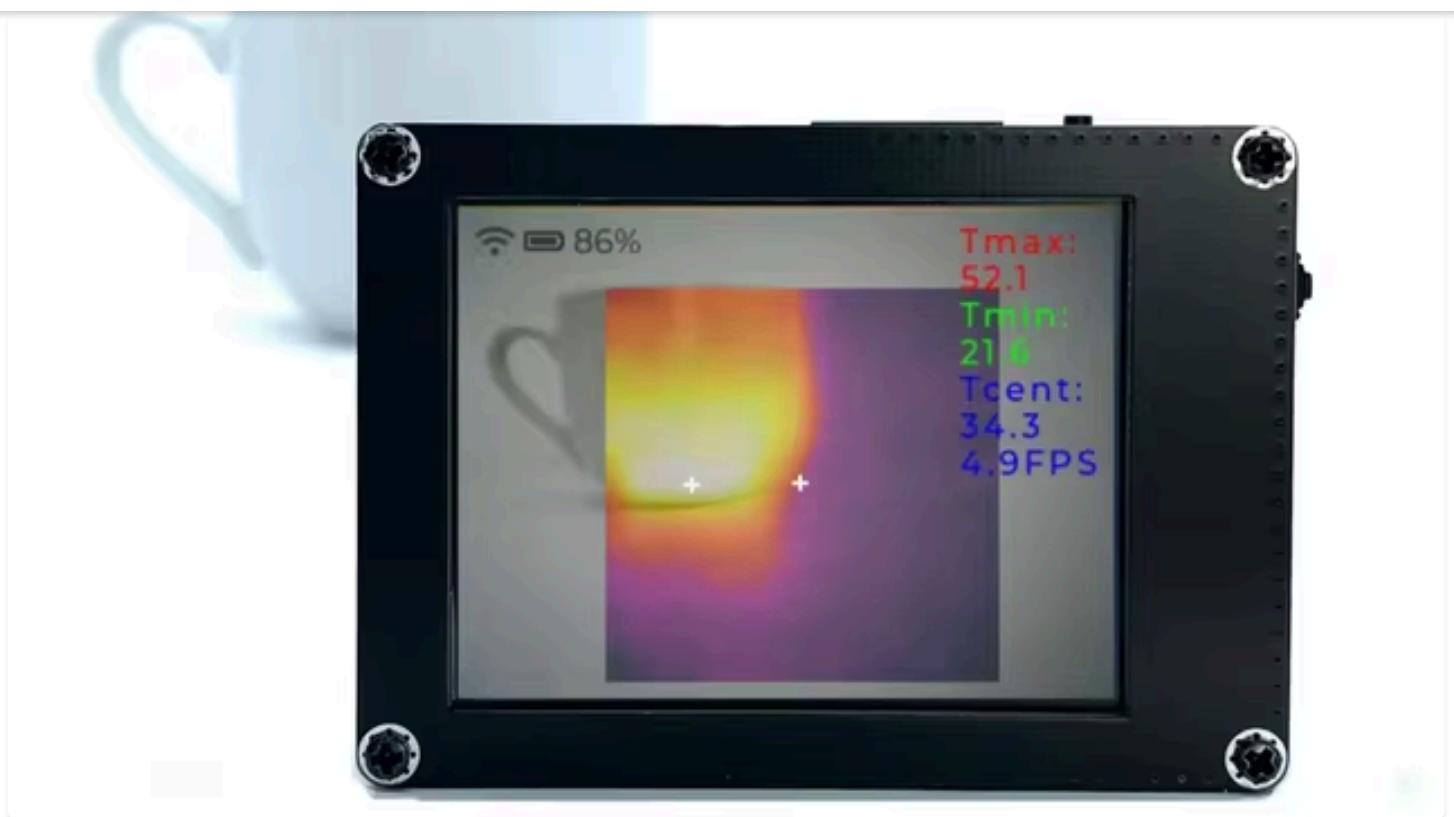
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(a)





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Do any of the current consumer (especially the small ones intended to connect to a mobile phone) contain dual sensors like this?

#### ❖ Sources

## Answer

Based on the search results provided, there is no specific information about current consumer-grade thermal cameras with dual sensors that are small enough to connect to mobile phones. The search results primarily focus on larger, more professional or industrial-grade thermal imaging systems with dual sensors.

However, it's worth noting that dual-sensor thermal cameras do exist in various forms:

1. Professional drones: The FLIR Duo and Duo Pro R are compact dual-sensor thermal cameras designed for drones <sup>2</sup>.
2. Security and surveillance: Systems like the SightLogix cameras use Dual Sensor Analytics (DSA) to combine thermal and visible imaging for improved outdoor detection <sup>4</sup>.
3. Traffic management: The FLIR TrafiSense2 Dual combines thermal and visual imaging for intersection control and traffic monitoring <sup>5</sup>.
4. Industrial and OEM applications: Products like the Teledyne FLIR Hadron series offer dual thermal and visible sensors in compact modules for integration into various systems <sup>3 6</sup>.

These examples are generally larger and more specialized than what would typically connect to a mobile phone. The search results don't provide information about consumer-grade, phone-compatible dual-sensor thermal cameras. If such products exist, they are not represented in the given search results.

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ZOTI 1080P HD Webcam





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The FLIR devices mentioned returned no results from Amazon. Anything like that available on Amazon for less than \$1K?

Answer

The FLIR One Edge Pro is a consumer-grade thermal imaging camera compatible with mobile devices and priced under \$1,000. It features FLIR MSX technology, which enhances thermal images by overlaying visible light details, but it does not have a true dual-sensor system with a separate visible light camera.

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Is there anything with at least 256x192 resolution in both sensors for under \$1K?

Sources

[HIKMICRO Pocket2 Thermal Camera - Compact High-Resolution ...](#)

[What is the best thermal camera under 300\\$ in 2023 ? I am ... - Reddit](#)

[Why such low resolution for T  
r/raspberry\\_pi](#)

mymeter.com

reddit

reddit

Answer

The **Topdon TC001** and **VEVOR Thermal Imaging Camera** both meet your requirements of at least 256x192 resolution for the thermal sensor and include a visible light sensor for under \$1,000.

- **Topdon TC001:** 256x192 IR resolution with a visible light lens and image fusion technology for enhanced details. Compact and suitable for Android devices.
- **VEVOR Thermal Imaging Camera:** 256x192 IR resolution, visible camera, 25Hz refresh rate, and features like real-time transfer and video recording.

Both options are affordable and provide dual-sensor functionality with decent specifications.

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## Does the TOPDON TC001 have any available Linux drivers or Python modules that can interact with it?

### Sources

[Use Topdon TC001 Thermal Cam with Python / Linux via a Webserver](#)

[python - Object Detection from Thermal Camera \(USB\) weird error](#)

[RPi/SBC/Topdon TC001/clone](#)

 [github](#)

 [stackoverflow](#)

 [eevblog](#)

### Answer

Yes, the TOPDON TC001 thermal camera has Linux support and Python modules available for interacting with it. Several open-source projects provide software to use this camera on Linux systems, including Raspberry Pi:

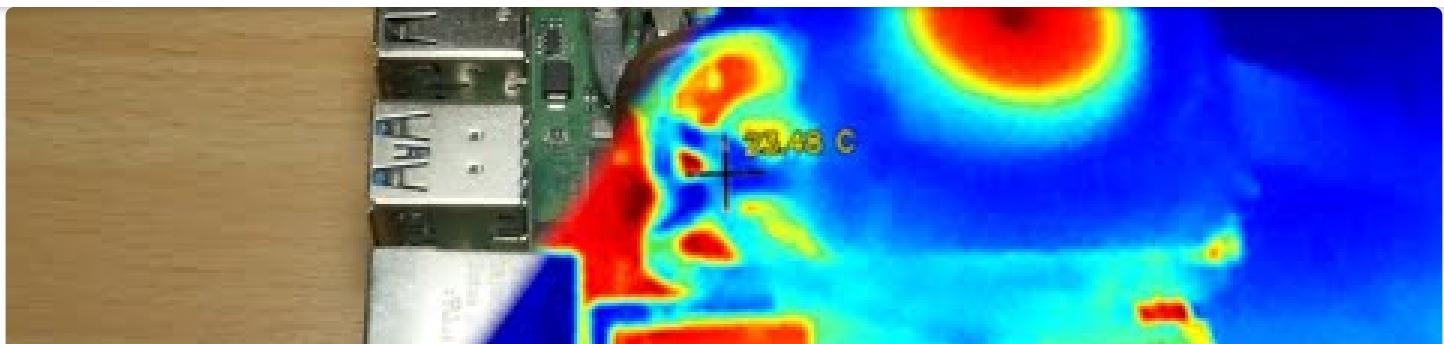
1. The "PyThermalCamera" project on GitHub offers Python software to use the TOPDON TC001 on Linux and Raspberry Pi <sup>5</sup>.
2. Another GitHub repository by user "tna76874" provides a Python-based web viewer for the TOPDON TC001, which can be installed via pip <sup>1</sup>.
3. The camera works with various Raspberry Pi models, including Pi 2, Pi 3, Pi Zero 2 W, and Pi 4, running Raspberry Pi OS (Debian-based) <sup>3</sup>.

These projects allow users to capture thermal images, process the data, and display results using Python. The camera doesn't require specific drivers, as it presents itself as a standard video device that can be accessed using OpenCV or other video capture libraries <sup>5</sup> <sup>7</sup>.

It's worth noting that these solutions are community-developed and may require some technical knowledge to set up and use effectively.

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Total Temperature Range:  
**-4 to 1022°F (-20 to 550°C)**

Normal temperature  
**-4 to 302°F (-20 to 150°C)**  
with high resolution

High temperature  
**302 to 1022°F (150 to 550°C)**  
with normal resolution

Standard Distance  
**0.8ft (0.25m)**

Recommended Distance  
within **16.4ft (5m)**

## TOPDON TC001 THERMAL CAMERA REVIEW





**TOPDON | Official Store**  
TC001 Thermal Imaging Camera

- IR Resolution **256x192 Pixels** **-4 to 1022°F** (-20 to +550°C)
- Heat Sensitivity **40mK** **Type-C Data Transfer**
- Image Enhancement Technology**

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Is 4915200 (4.9 million) bits per second under the USB 2.0 specs? This is the super resolution (512x384) \* 25 hz bit rate of the TOPDON TC001 for Android (micro USB I think).

#### ❖ Sources

[USB: Port Types and Speeds Compared - Tripp Lite - Eaton](#)

[USB - Wikipedia](#)

[What are the USB data transfe](#)

tripplite.eaton

en.wikipedia

sony

#### ❖ Answer

Yes, 4,915,200 bits per second (4.9 Mbps) is well within the USB 2.0 specifications. USB 2.0, also known as Hi-Speed USB, has a maximum theoretical data transfer rate of 480 Mbps <sup>1 2 5</sup>. The TOPDON TC001's bit rate of 4.9 Mbps for its super resolution mode (512x384 at 25 Hz) is significantly lower than this maximum, so it should be easily accommodated by a USB 2.0 connection.

To put this in perspective:

1. USB 2.0 maximum speed: 480 Mbps
2. TOPDON TC001 bit rate: 4.9 Mbps

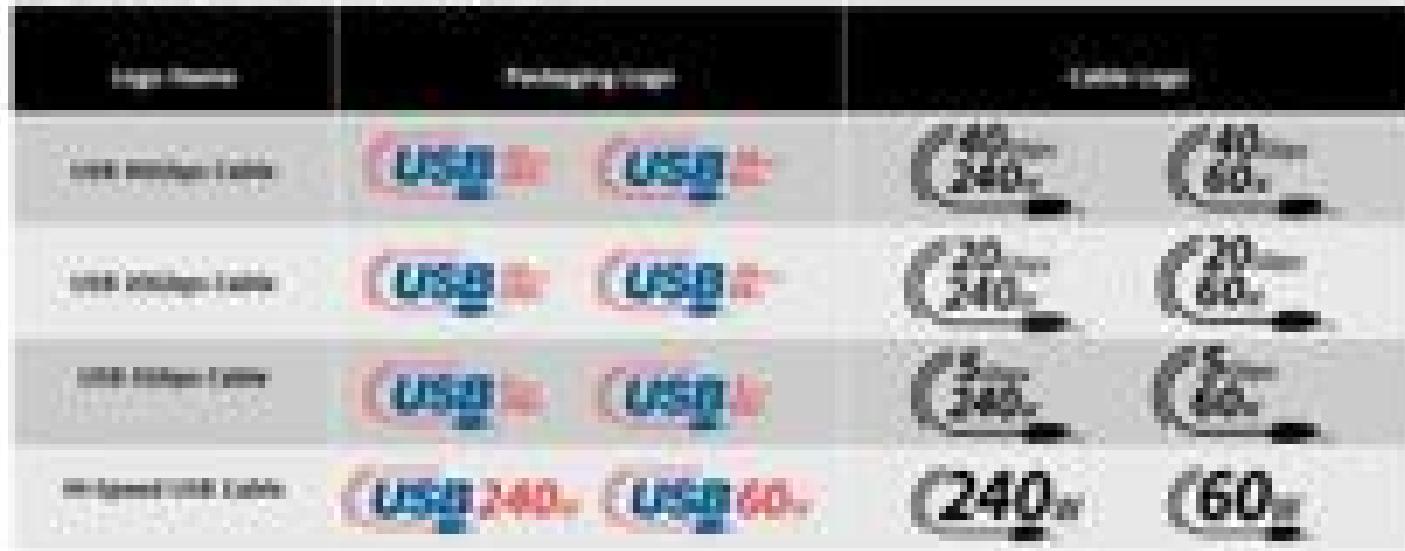
The camera's data rate is less than 1.1% of USB 2.0's maximum theoretical speed, leaving ample bandwidth for data transfer. Even accounting for real-world limitations and overhead, USB 2.0 should handle this data rate without issues.

It's worth noting that if the device uses a micro USB connector, it's likely using USB 2.0 specifications, as this was common for Android devices before the widespread adoption of USB-C.

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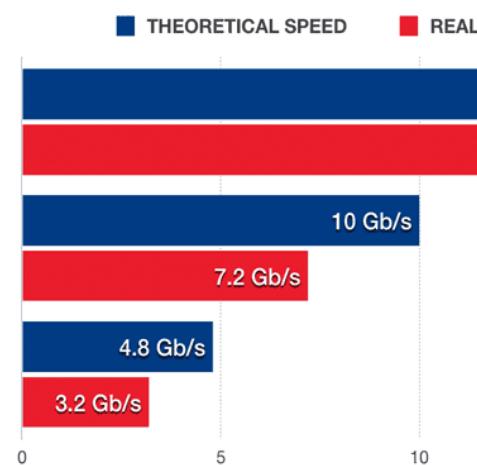
USB Version				Bandwidth	DATA Transfer Speed	Logo	Connector
Official release		Slogan	Marketing name				
USB4	V1.0	USB4 20Gbps USB4 40Gbps	USB4	20 or 40Gbps	2560MB~5120 MB/s		
USB 3.2	Gen 2x2	SuperSpeed+	USB 3.2	20Gbps	2560MB/s		
	Gen 2		USB 3.1	10Gbps	1280MB/s		
	Gen 1	SuperSpeed	USB 3.0	5Gbps	640MB/s		
USB	2.0	High-Speed	USB 2.0	480Mbps	60MB/s		
	1.1	Full Speed	USB 1.1	12Mbps	1.5MB/s		
	1.0		USB 1.0	1.5Mbps	0.192MB/s		

## Cable USB logos



Channel 1100 Home

Data Transfer Speed	Up to <b>480 Mbps</b>	Up to <b>5 Gbps</b>	Up to <b>40 Gbps</b>
Power Delivery	Up to <b>2.5W</b>	Up to <b>4.5W</b>	Up to <b>240W</b>
Data Transfer Direction	<b>Half-duplex</b>	<b>Full-duplex</b>	<b>Full-duplex, with dynamic allocation</b>
Use Cases	Mice, keyboards, basic webcams, basic charging cables	External hard drives, high-speed data storage, HD cameras	High-definition display connectivity, rapid data transfer for large files, docking stations,



## Flavors: A 2021 Guide

Year of Introduction	Maximum Speed
2019	40Gbps
2017 (as USB 3.2)	20Gbps
2014 (as USB 3.1)	10Gbps
2009 (as USB 3.0)	5Gbps
2001	480Mbps
1996	12Mbps

Year	Logo	Data transfer speed
1998		12 Mbps
2000	USB	480 Mbps
2008	SS	4.8 Gbps
2013	SS <sup>5</sup>	5 Gbps
2013	SS <sup>10</sup>	10 Gbps

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Thanks, just ordered that. Hopefully I can get it working with Ubuntu and process incoming data in realtime with SLAM...though if I mount the camera SLAM wouldn't have any parallax...I'd have to have two of them...hmmm.

### Sources

Use Topdon TC001 Thermal Cam with Python / Linux via a Webserver

3D Radiometric Mapping by Means of LiDAR SLAM and Thermal ...

leswright1977/PyThermalCam

## Answer

Great choice! The TOPDON TC001 should work well with Ubuntu, and you can indeed process the incoming data in real-time. Here are some key points to consider:

1. Linux compatibility: The TC001 is supported on Linux systems, including Ubuntu <sup>1</sup> <sup>3</sup>.
2. Python modules: There are open-source Python projects available for interacting with the TC001, such as "PyThermalCamera" and a web viewer <sup>1</sup> <sup>3</sup>.
3. Real-time processing: The camera presents itself as a standard video device, allowing access through OpenCV or other video capture libraries for real-time data processing <sup>1</sup>.
4. SLAM considerations: You're correct that mounting a single thermal camera wouldn't provide parallax for traditional SLAM. However, there are some alternatives to consider:
  - a. Thermal-Inertial Odometry: Combining the thermal camera with an IMU can enable SLAM-like functionality <sup>6</sup>.
  - b. FirebotSLAM: This algorithm uses stereo thermal images to create 3D maps in challenging environments <sup>4</sup>.
5. Dual camera setup: Using two TC001 cameras could indeed provide the parallax needed for traditional SLAM approaches <sup>4</sup>.
6. Long-term support: The open-source nature of available software means you're not solely reliant on manufacturer support <sup>10</sup>.

As you explore SLAM with thermal imagery, keep in mind that it presents unique challenges, such as low contrast and diurnal changes in thermal appearance. Recent research has focused on developing specialized feature descriptors and matching techniques for thermal SLAM <sup>8</sup>.

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If I get the T2 Pro, would it be possible to combine the thermal data from the two cameras using SLAM (instead of visual light)?

### Sources

[InfiRay T2 Pro thermal camera for Android - Eleshop](#)

[Sparse Depth Enhanced Direct Thermal-infrared SLAM Beyond the ...](#)

[InfiRay Thermal Eye T2 Pro - t](#)



## Answer

Yes, it would be possible to combine thermal data from two T2 Pro cameras using SLAM techniques specifically designed for thermal imagery. This approach is known as Thermal SLAM and has several advantages:

1. Robustness: Thermal cameras are effective in low-light conditions and can see through smoke and fog, making them ideal for challenging environments <sup>2</sup> <sup>8</sup>.
2. Specialized algorithms: Recent research has developed SLAM algorithms tailored for thermal imagery. For example, FirebotSLAM uses stereo thermal images to create 3D maps in smoke-filled environments <sup>10</sup>.
3. Thermal-Inertial Odometry (TIO): This method combines thermal camera data with inertial measurement unit (IMU) information for improved localization and mapping <sup>6</sup>.

4. Feature extraction: Thermal SLAM systems often use specialized feature extraction and description methods optimized for thermal imagery <sup>10</sup>.
5. Long-range capabilities: The T2 Pro's 13mm lens and 256x192 resolution provide a detection range of up to 1400 yards, which could be beneficial for large-scale SLAM applications <sup>5 7</sup>.

By using two T2 Pro cameras, you would gain the necessary parallax for stereo vision, enabling depth perception and 3D mapping. This setup could potentially overcome some limitations of single-camera thermal SLAM systems and provide more accurate localization and mapping in challenging environments.

 Share  Rewrite

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Cool, I'll use the thermal data for SLAM and the visual data from the TC001 for the star filtering (hopefully it'll have enough resolution to at least pick up some stars).

### Answer

That's an excellent approach! Using the thermal data for SLAM and the visual data for star filtering is a smart combination. Here's a breakdown of your plan:

1. Thermal SLAM:
  - Using the thermal data from the TC001 for SLAM will provide robust performance in various lighting conditions and environments.
  - The 256x192 resolution of the thermal sensor should be sufficient for feature detection and tracking.
2. Star Filtering with Visual Data:
  - The TC001's visible light camera can indeed be used for star detection.
  - While the resolution might not be as high as specialized astronomical cameras, it should still be capable of detecting brighter stars under good conditions.

Some considerations:

- Star Detection: The success of star detection will depend on factors like light pollution, weather conditions, and exposure settings. You might need to experiment with camera settings to optimize star visibility.
- Integration: Combining the SLAM data with star filtering results could provide interesting possibilities for navigation or orientation.
- Processing: Real-time processing of both thermal and visual data streams might be computationally intensive. Ensure your system has sufficient processing power.
- Calibration: You'll need to carefully calibrate the alignment between the thermal and visual cameras for accurate data fusion.

This innovative approach combines the strengths of both thermal and visual imaging, potentially leading to a robust system for navigation and environmental understanding. It's an exciting project with lots of potential for further development!

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While I'm waiting for the camera to arrive (and getting ready to order the other one), I need to setup the web server to get http API functionality with Stellarium. Do you know the steps for that on Ubuntu?

### Sources

[How to Install Stellarium on Ubuntu - GeeksforGeeks](#)

[Install Stellarium on Linux | Snap Store - Snapcraft](#)

stellarium version 23.1 did not  
22.04.2

 geeksforgeeks

 snapcraft

 github

## Answer

To set up the HTTP API functionality with Stellarium on Ubuntu, follow these steps:

1. Install Stellarium using the command:

```
text
sudo apt-get install stellarium-qt6
```

2. Launch Stellarium and navigate to Configuration > Tools > Plugins.

3. Enable the "Remote Control" plugin by checking its box.

4. Configure the plugin settings:
  - Set the desired port number (default is 8090)
  - Choose whether to allow connections from other machines

5. Restart Stellarium for the changes to take effect.

6. Access the HTTP API by opening a web browser and navigating to:

```
text
http://localhost:8090/api/main/status
```

Replace "localhost" with your machine's IP address if accessing from another device.

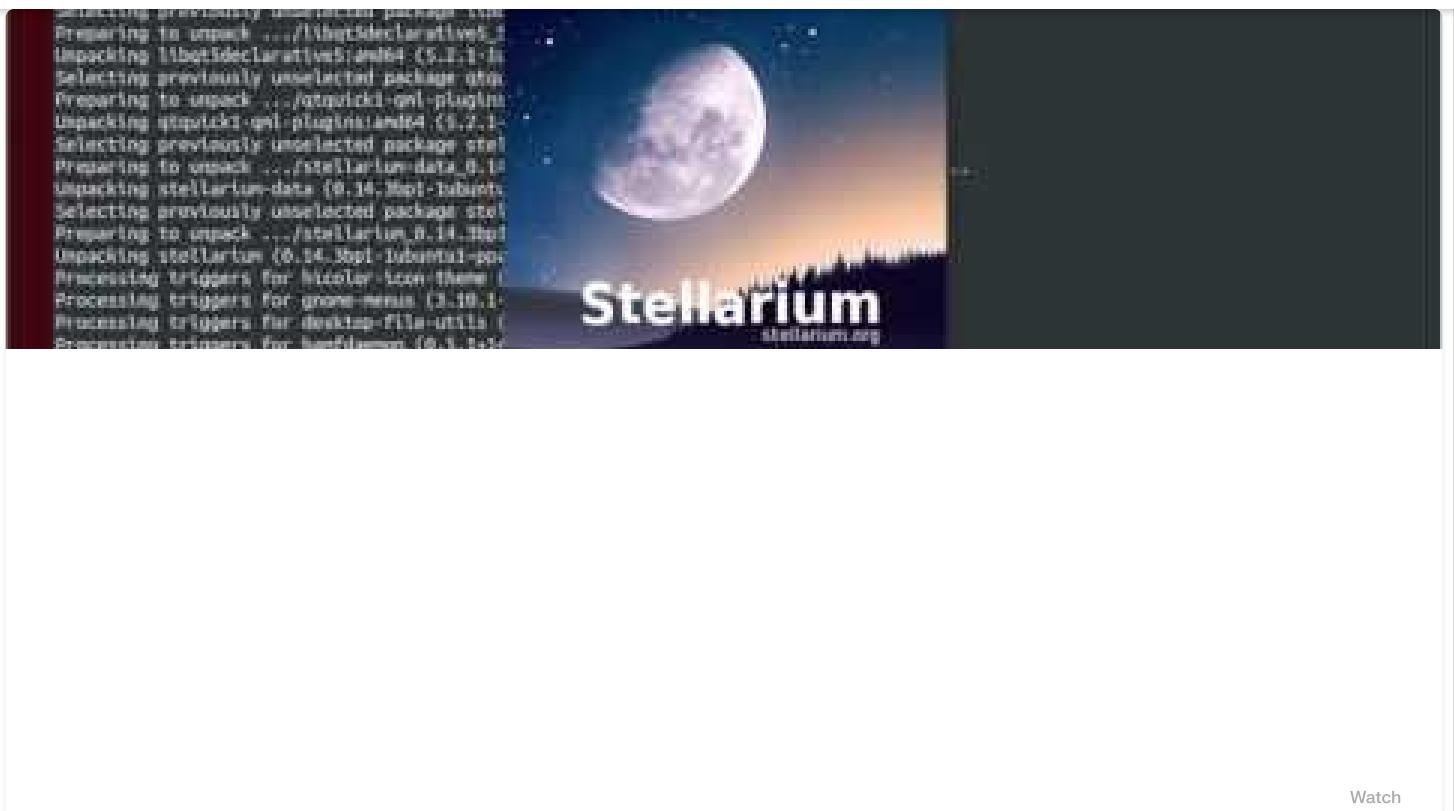
7. You can now use HTTP GET requests to control Stellarium remotely. For example:

```
text
http://localhost:8090/api/main/focus?target=Mars
```

Remember to check Stellarium's documentation for a full list of available API commands and their usage.

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Watch

### Moon

Type: moon  
 Magnitude: **22.30** (reduced to **22.43** by **1.05** Airmasses)  
 Absolute Magnitude: 0.21  
 Mean Opposition Magnitude: -12.74  
 RA/Dec (J2000.0): 17h28m51.07s/-23°14'26.0"  
 Az./Alt.: +23°31'19.9"/+72°12'55.9" (apparent)  
 Mean Sidereal Time: 16h59m39.3s  
 Apparent Sidereal Time: 16h59m38.2s  
 Rise: 4h31m  
 Transit: 11h55m  
 Set: 19h20m  
 IAU Constellation: Oph  
 Distance from Sun: 0.982 AU (146,885 M km)  
 Distance: 0.002395 AU (358319.459 km)  
 Light time: 0h00m01.2s  
 Equatorial rotation velocity: 0.005 km/s  
 Apparent diameter: +0°33'20.24"  
 Diameter: 3474.8 km

**Astronomical calculations**

Phenomenon	Date and Time	Object 1	Mag. 1	Object 2	Mag. 2	Separation	Solar Elongation	Lunar Elongation
Eclipse	2020-12-14 11:24:29	Moon	22.16	Sun	-	-	-	-
Opposition	2020-12-30 11:39:17	Moon	-12.22	Mercury	-1.03	+179°33'05.7"	+6°28'26.7"	-

Between objects: Moon and Planets and Sun  
 From: 2020-12-01 To: 2020-12-31  
 Maximum allowed separation: +1° 0' 0.00" Calculate:  oppositions  perihelion and aphelion

Cleanup of phenomena Save phenomena Calculate phenomena

2020-12-09  
2020-12-10  
2020-12-11  
TODAY:  
Rose at 4:17 (7h 7m 0s ago)  
Sets at 19:40 (in 8h 15m 0s)  
Culminates at 11:55 (in 31m 0s) at 73.5 deg.  
THIS YEAR:  
Previous Full Moon: Nov 30 at 4:47. Next Full Moon: Dec 29 at 22:45.  
Heliacal rise/set: Jan 14/None.

Earth, -39°50'09", -70°49'18"  
FOV 4.11° 17.9 FPS 2020-12-14 11:24:29 UTC-04:43 (LMST)

```
sudo apt-get update & sudo apt-get install -y software-properties-common  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following additional packages will be installed:  
  libapt-inst1.0 libapt-pkg4.1 libapt-pkg5.0 libapt-pkg5.1 libapt-pkg5.2 libapt-pkg5.3 libapt-pkg5.4  
The following NEW packages will be installed:  
  libapt-inst1.0 libapt-pkg4.1 libapt-pkg5.0 libapt-pkg5.1 libapt-pkg5.2 libapt-pkg5.3 libapt-pkg5.4  
0 upgraded, 0 newly installed, 0 to remove and 0 not upgraded.  
Need to get 0 B of archives.  
After this operation, 0 B of additional disk space will be used.  
Do you want to continue [Y/n]?  
get:1: http://de.archive.ubuntu.com/ubuntu/jammy/universe amd64 libapt-inst1.0-2.20.3-0ubuntu-1 [154 kB]  
get:2: http://de.archive.ubuntu.com/ubuntu/jammy/universe amd64 libapt-pkg5.0-1.15.5-0 [218 kB]  
get:3: http://de.archive.ubuntu.com/ubuntu/jammy/universe amd64 libapt-pkg5.1-1.15.6-0 [412 kB]  
get:4: http://de.archive.ubuntu.com/ubuntu/jammy/universe amd64 libapt-pkg5.2-1.15.7-0 [414 kB]  
get:5: http://de.archive.ubuntu.com/ubuntu/jammy/universe amd64 libapt-pkg5.3-1.15.8-0 [409 kB]  
5% [http://de.archive.ubuntu.com/ubuntu/jammy/universe amd64 libapt-pkg5.4-1.15.9-0 [409 kB])
```

