DepthVista

DepthVista Console Application User Manual

Version 1.5

e-con Systems

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e-con Systems

Think Camera. Think e-con.

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Contents

Introduction to DepthVista

DepthVista is a 3D camera based on Time of Flight (TOF) technology, USB Video Class (UVC) compliant, USB 3.2 Gen 1 SuperSpeed USB camera from e-con Systems, a leading Embedded Product Design Services Company which specializes in advanced camera solutions.

DepthVista is an RGB-D camera containing both RGB and TOF depth cameras. RGB camera has 1/2.6" AR0234CS CMOS digital image sensor with global shutter from onsemi™. It has dedicated high performance color image signal processor. TOF depth camera has 1/4" CCD sensor and dedicated depth processor. DepthVista is a two-board solution containing camera board with the USB 3.2 Gen 1 interface and laser board along with enclosure.

This document describes the special features of sample console application when it is used with DepthVista.

Prerequisites

Please refer to the Installation Manual (https://github.com/econsystems/opencv/tree/master/Documents) for more detailed installation steps and images.

Description

DepthVista has USB interface controller with USB Type-C connector to interface with the host PC. It is a ready-to-manufacture camera board with all the necessary firmware built-in and is compatible with the UVC version 1.0 standard. You can integrate this camera into the products, and this helps to cut short the time-to-market.

DepthVista is a UVC compatible and will work with the standard drivers available with Windows and Linux OS. There is no need for any additional driver installation. So, video streaming through UVC is possible without any special drivers on OSes that have built-in support for UVC standards.

Table 1: DepthVista Supported Format, Resolutions, and Frame Rates

S.No	Format	Camera Mode	Resolution	Frame Rate (fps) USB 3.2 Gen 1
1	UYVY	RGB Mode	2.3MP (1920 x 1200)	30
			FHD (1920 x 1080)	30
			HD (1280 x 720)	60
			VGA (640 x 480)	60
2		TOF Mode	Depth (640 x 480)	30

	Y16 (RAW 12-bit)		IR (640 x 480)	30
			Depth + IR (640 x 960)	30
3		RGB-D Mode	1280 x 600 (RGB-D)	30
			1443 X 960 (RGB-D)	30

The TOF camera in DepthVista can be used in two depth modes as follows:

- **Far Mode**: Effective depth range is between 1000 mm to 6000 mm.
- **Near Mode**: Effective depth range is between 200 mm to 1200 mm.

The TOF camera controls of DepthVista are as follows:

- TOF Data Mode
- TOF Depth Range
- TOF Mask
- TOF Gain

The RGB camera controls of DepthVista are as follows:

- Brightness
- Contrast
- Saturation
- Gamma
- Gain
- Sharpness
- White Balance
- Exposure
- Power line frequency

This document explains the following sections:

- Selecting the supported preview resolutions.
- Using supported controls.

Installing DepthVistaSDK for Linux

This section describes the installation of DepthVistaSDK which is essential for building DepthVista Application.

The steps to install the DepthVistaSDK are as follows:

1. Run the following command to extract the **package** file.

   ```
   unzip -X <packageName.zip>
   ```

   <Extracted Directory>\Linux\Bin\Ubuntu18.04\x64\SDK will have an install.sh file.

   Note: For Ubuntu 20.04 the install.sh file will be present in **<Extracted Directory>\Linux\Bin\Ubuntu20.04\x64\SDK.**

2. Open the folder containing install.sh in terminal.

3. Run the following command to give executable permission for install.sh file.

   ```
   chmod +x install.sh
   ```

4. Run the following command to install the **DepthVistaSDK**.

   ```
   sudo ./install.sh
   ```

   Once installation is success, **Installation DepthVistaSDK success** message appears.

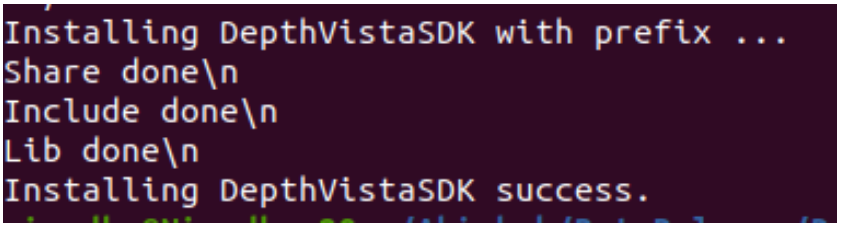

Fig 1: Installation success screenshot.

Using DepthVista Console Application

This section describes how to use the DepthVista console application.

Launching Linux DepthVista Console Application

The steps to launch linux DepthVista Console application are as follows:

1. Run the following command to extract the **package** file.

```
unzip -X <packageName.zip>
```

   <Extracted Directory>\linux\Bin\Ubuntu18.04\x64\Bin will contain DepthVistaConsoleApp executable file.

   Note: For Ubuntu 20.04, the DepthVistaConsoleApp executable file will be present in **<Extracted Directory>\linux\Bin\Ubuntu20.04\x64\Bin.**

2. Run the following command to run the application.

```
sudo ./DepthVistaConsoleApp
```

Launching Windows DepthVista Console Application

The steps to launch Windows DepthVista Console Application are as follows:

1. Extract the given Package.

   <Extracted Directory>/Windows/Bin/CMD/x64 will contain the DepthVistaConsoleApp.exe file.

2. Double click the DepthVistaConsoleApp.exe.

Selecting the Camera Device

Initially the command line displays the number of devices connected to the PC. You must select the camera device to explore their features through the command line application.

Figure 2: Application Launch Screen

Selecting Camera Properties

Once the device is selected, Depth-IR stream will start and camera properties that can be explored will be listed as shown below.

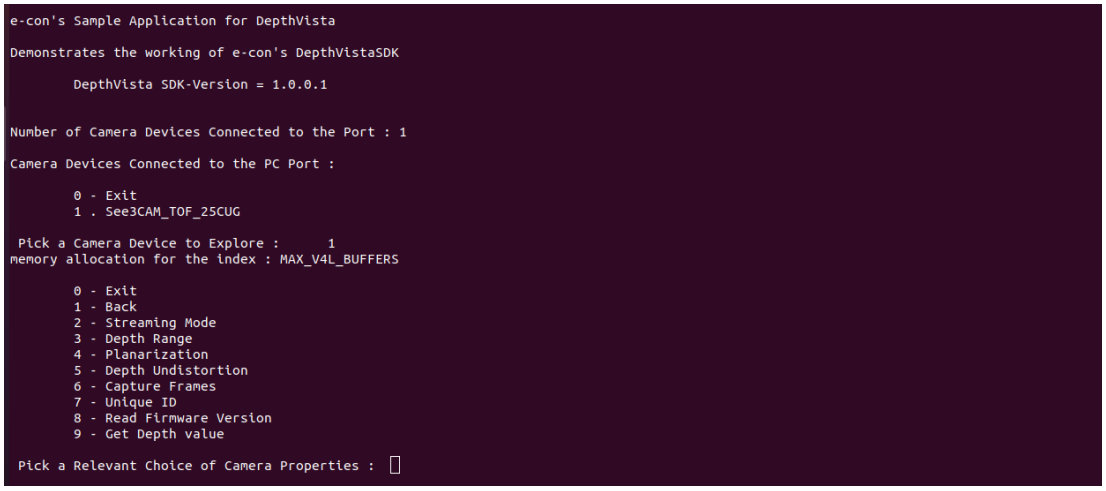

Figure 3: Selecting Camera Property

Selecting Streaming Mode

The steps to select the Streaming mode are as follows:

1. Enter **2** in **Pick a Relevant Choice of Camera Properties** to select the **Streaming Mode**.

   After selecting the Streaming mode option, all the streaming modes supported by the device will be listed as shown below.

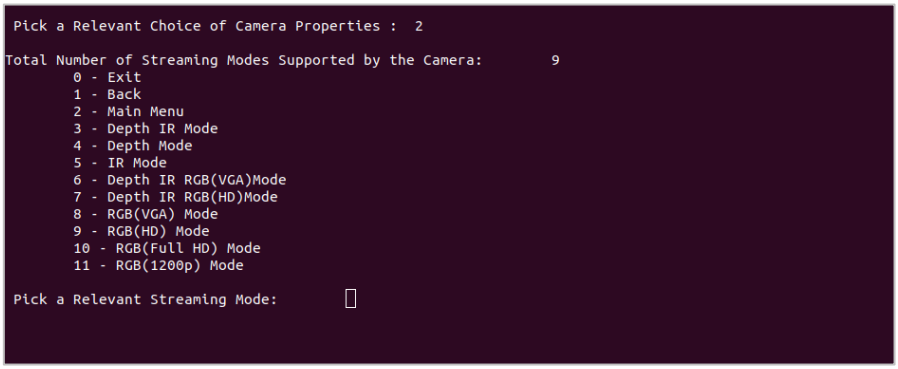

Figure 4: Supported Streaming Modes

The options to set the streaming mode are as follows:

- Option **0** to exit from the application.
- Option **1** to go back to the previous menu.
- Option **2** to return to Main Menu.
- Option **3** to set Depth IR streaming Mode.
- Option **4** to set Depth streaming Mode.
- Option **5** to set IR streaming Mode.
- Option **6** to set Depth IR RGB(VGA) streaming Mode.
- Option **7** to set Depth IR RGB(HD) streaming Mode.
- Option **8** to set RGB (VGA) streaming Mode.
- Option **9** to set RGB (HD) streaming Mode.
- Option **10** to set RGB (Full HD) streaming Mode.
- Option **11** to set RGB (1200p) streaming Mode.

After selecting the preferred streaming mode, user can view the preview based on the selected streaming mode.

Selecting Depth Range

The steps to select the Depth Range are as follows:

1. Enter **3** in **Pick a Relevant Choice of Camera Properties** to select the **Depth Range**.

   After selecting the Depth range option, all the depth ranges supported by the device will be listed as shown below.

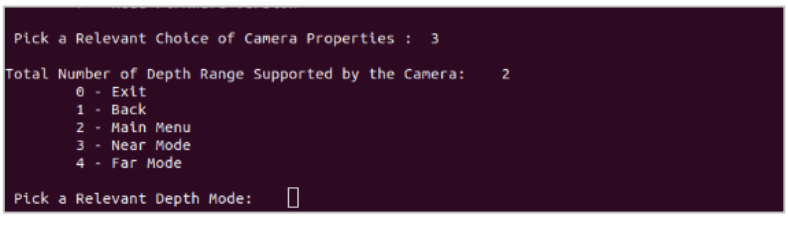

Figure 5: Supported Depth Ranges

The options to set the depth range are as follows:

- Option **0** to exit from the application.
- Option **1** to go back to the previous menu.
- Option **2** to return to main menu.
- Option **3** to set Near Mode.
- Option **4** to set Far Mode.

After selecting the preferred depth range, streaming will be updated based on the depth range selected.

Setting Planarization

The options to select the Planarization are as follows:

1. Enter **4** in **Pick a Relevant Choice of Camera Properties** to select **Planarization**.

   After selecting the Planarization option, you will have the options listed as shown.

Figure 6: Enabling and Disabling Planarization

The options to set the planarization are as follows:

- Option **0** to exit from the application.
- Option **1** to go back to the previous menu.
- Option **2** to return to main menu.
- Option **3** to disable Planarization.
- Option **4** to Enable Planarization.

After selecting the preferred planarization, streaming will be updated.

Setting Undistortion

The steps to select the Undistortion are as follows:

1. Enter **5** in **Pick a Relevant Choice of Camera Properties** to select **Undistortion**.

   After selecting the Undistortion option, you will have the options listed as shown.

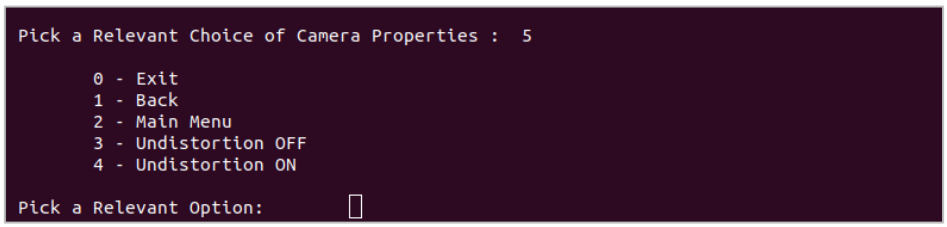

Figure 7: Enabling and Disabling Undistortion

You can set the Undistortion using the following options:

- Option **0** to exit from the application.
- Option **1** to go back to the previous menu.
- Option **2** to return to main menu.
- Option **3** to disable Undistortion.
- Option **4** to Enable Undistortion.

After selecting the preferred Undistortion, streaming will be updated.

Capturing Frames

The steps to capture frames are as follows:

1. Enter **6** in **Pick a Relevant Choice of Camera Properties** to capture images.

Images will be saved based on the streaming mode and the location of the images will be shown as follows.

Figure 8: Capturing Frames

The files will be saved with the name as shown below.

- RGB Frame – DepthVista_RGB_yyyy_mm_dd_hrs_min_sec.bmp
- IR Frame – DepthVista_IR_yyyy_mm_dd_hrs_min_sec.png
- Depth Raw Frame – DepthVista_Raw_yyyy_mm_dd_hrs_min_sec.raw
- Depth Color map - DepthVista_Depth_yyyy_mm_dd_hrs_min_sec.bmp

Reading Unique ID

Enter **7** in **Pick a Relevant Choice of Camera Properties** to read the Unique ID of that specific device. Unique ID of the device will be displayed as shown below.

Figure 9: Reading Unique ID of Device

Reading Firmware Version

Enter **8** in **Pick a Relevant Choice of Camera Properties** to read the firmware version of that specific device. Firmware version of the device will be displayed as shown below.

Figure 10: Reading Firmware Version of Device

Get Depth Value

The steps to get Depth Values are as follows:

1. Before trying to get Depth value, start any stream that enables depth streaming mode, else a message saying “Start Depth stream to get depth value” will appear.

2. After starting any stream that enables depth streaming mode, enter **9** in **Pick a Relevant Choice of Camera Properties** to select the **Get Depth Value**.

   After selecting the Get Depth Value option, a list of options will be listed as shown below.

Figure 11: Get Depth value options

You can get the Depth value using the following options:

- Option **0** to exit from the application.
- Option **1** to go back to the previous menu.
- Option **2** to return to main menu.

- Option **3** to Get the depth value of centre pixel.
- Option **4** to Get the depth value of any pixel whose X co-ordinates range from 0 to 639 and Y co-ordinates range from 0 to 479.

After selecting option **4** Enter X co-ordinate and Y co-ordinate of the pixel to get the depth value.

Exiting the Application

Enter **0** in **Pick a Relevant Choice of Camera Properties** to exit the application.

In the DepthVista sample application, the device is selected but the preview window is black.

- Please make sure that the external power supply is connected to the device and then restart the application.
- Please check whether the device is connected to USB 2.0. If so, as this device supports only USB 3.2 Gen 1 interface, please connect the device to USB 3.2 Gen 1 port and then restart the application.
- You need to install the latest version of DepthVista sample application from the Developer Resources website.

Make sure external power supply is connected and the device is connected to USB 3.2 Gen 1 Interface. Then in the DepthVista sample application, the preview window is black.

It seems like no image is received from the camera. Contact e-con Systems online support support@e-consystems.com.

Error: error while loading shared libraries: libdc1394.so.25: cannot open shared object file: No such file or directory

Warning: libdc1394.so.25, needed by /usr/lib/libopencv_world.so.4.2.0, not found

Run the following command in terminal to solve the issue.

```
sudo apt-get install libdc1394-25
```

FAQ

1. **Does external power supply require for this camera?**

   Yes, we need external power supply to get depth frames and it will be provided with the kit**.**

2. **What is the supported external power supply current ratings?**

   The supported external power supply current ratings are listed below.

   Input: AC 100-240v, 50/60HZ
   Output: DC 12V, 4A

3. **What is the current operating temperature range supported by DepthVista?**

   The current operating temperature range supported is 0°C to 50°C.

4. **What is the light source used in this camera?**

   This camera uses 2 VCSEL laser diodes that work in the NIR (Near InfraRed) spectrum (850nm) and is safe for human eyes.

5. **Can the depth range be improved further?**

   Yes. Depth range can be improved by changing the no of VCSEL LEDs and their intensity. This is going to involve a customization effort.

6. **Is DepthVista suitable for outdoor environment?**

   As the laser diodes used in this camera operate in the 850nm NIR range, the likelihood of interference from sunlight is very high if you use it in outdoor applications. Hence, this camera is more suitable for indoor environments.

7. **What's the maximum accuracy that can be achieved?**

   DepthVista offers an accuracy of <1%.

8. **Is the DepthVista camera pre-calibrated?**

   Yes, this camera is factory calibrated. Do not disturb the casing or the lens, which would alter the calibration done.

9. **What is the minimum distance that the lens could focus?**

   The minimum working distance (distance between the camera and the object) for this camera is 20 cm.

10. **Are these ToF and RGB sensors synchronized?**

Yes. Both these sensors work synchronously to make the best use of the depth and RGB data streams.

11. **What is IMU?**

    Inertial Measurement Units (IMUs) is a self-contained system that measures linear and angular motion usually with a triad of gyroscopes and triad of accelerometers and sometimes the magnetic field surrounding the body, also magnetometers.

    IMU chip used is a 6d of (degree of freedom) IMU (Inertial Measurement Unit) featured with triaxial accelerometer and triaxial gyroscope, supports different modes of configuration.

12. **Why is this camera not supported in USB 2.0?**

    Due to Bandwidth limitations of RGB-D streaming in USB 2.0, this camera supports only USB 3.2 Gen1 speed.

13. **What is the depth resolution and frame rate supported by DepthVista?**

    DepthVista supports a resolution of 640x480 at a frame rate of 30 fps for depth measurement.

14. **What are the output formats supported by DepthVista camera?**

    The output formats supported by DepthVista camera are as follows:

Mode	Format
TOF	Y16(RAW 12-bit)
RGB	UYVY
RGB-D	Y16

15. **What is DepthVista SDK?**

    DepthVista Software Development Kit (SDK) package is built on OpenCV(**opencv-4.2.0**) Images Processing Library is bundled with DepthVista USB 3.2 Camera. SDK currently uses C++ API's of OpenCV.

16. **How to install the DepthVista?**

    DepthVista Installer package will be available with DepthVista deliverables. Follow the procedure in the document named *DepthVista_Windows_Installation_Manual.pdf* for Windows OS and *DepthVista_Linux_Installation_Manual.pdf* for Linux.

17. **Do we share the DepthVista sample application source code?**

    Yes, DepthVista sample application source code will be shared along with the SDK.

18. **What are the operating systems supported by DepthVista?**

    The operating systems are Windows 10, Ubuntu 18.04 and Ubuntu 20.04.

19. **What is the shutter type on the sensor?**

    Both the TOF and RGB camera sensors are global shutter sensor.

20. **Does DepthVista comes with an enclosure?**

    Yes. This camera comes with a metal enclosure.

21. **What is the lens used in the DepthVista camera – TOF and RGB?**

    The lens used in the camera is S-mount (M12).

Description	RGB Camera Lens	Depth Camera Lens
Focal Length	3.252mm	2.16mm
Diagonal FOV	90.09	99.75

22. **What is the lens mount used?**

    The lens mount used in the DepthVista Camera reference design is S-mount M12 lens holder (M12 P0.5 lenses are supported by default).

23. **What is calibration? Why should I do that?**

    In DepthVista camera, we do depth calibration. Depth calibration process is carried out to get the accurate depth from the depth camera. Once the depth calibration is completed, calibration result parameters are programmed to the memory allotted for calibration in the SPI-flash.

24. **Can I get the depth of each and every pixel in the depth measurement resolution?**

    Yes, use the DepthVista sample application in the SDK, where the depth of the point selected by the you are displayed.

25. **What are the warranty terms of DepthVista camera?**

    For warranty, please refer the warranty page.

What's Next?

After understanding the usage of DepthVista console application, you can refer to the following documents to understand more about DepthVista.

- DepthVista Windows Installation Manual
- DepthVista Linux Installation Manual
- DepthVista SDK API Manual

Glossary

SDK: DepthVista Software Development Kit

TOF: Time of Flight.

ROI: Region of Interest.

USB: Universal Serial Bus.

UVC Compliant: USB Video Class Compliant.

Support

Contact Us

If you need any support on DepthVista product, please contact us using the Live Chat option available on our website - https://www.e-consystems.com/

Creating a Ticket

If you need to create a ticket for any type of issue, please visit the ticketing page on our website - https://www.e-consystems.com/create-ticket.asp

RMA

To know about our Return Material Authorization (RMA) policy, please visit the RMA Policy page on our website - https://www.e-consystems.com/RMA-Policy.asp

General Product Warranty Terms

To know about our General Product Warranty Terms, please visit the General Warranty Terms page on our website - https://www.e-consystems.com/warranty.asp

Revision History

Rev	Date	Description	Author
1.0	06-July-2022	Initial Draft	Camera Products
1.1	02-November-2022	Added Installation steps	Camera Products
1.2	04-November-2022	Modified Installation steps for Linux	Camera Products
1.3	18-May-2023	Document Update	Camera Products
1.4	05-June-2023	Document Update	Camera Products
1.5	15-June-2023	Document Update	Camera Products