DepthVista

DepthVista Console Application User Manual

Version 1.2

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e-con Systems

Think Camera. Think e-con.

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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 a 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$_{TM}$. 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 camera application when it is used with DepthVista.

Prerequisites

You must have OpenCV installed in your PC. 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	Y16 (RAW 12-bit)	TOF Mode	Depth (640 x 480)	30
			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

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

- **Far Mode**: Effective depth range is between 1000 mm to 6500 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.

- Extract the **package** file using the following command.

```
unzip <packageName.zip>
```

- **<Extracted Directory>\linux\Bin\Ubuntu18.04\x64\SDK\DepthVistaSDKInstaller** will have a install.sh file.

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

- Open the folder containing install.sh in terminal
- Run the following command to give executable permission for install.sh file

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

- Install the DepthVistaSDK with the following command

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

- Once installation is success, you will get "**Installation DepthVistaSDK success**".

Using DepthVista Application

This section describes how to use the DepthVista console application.

Launching Linux DepthVista Console application

- Extract the **package** file using the following command.

```
unzip <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**)

- Run the following command to run the application.

```
sudo ./DepthVistaConsoleApp
```

Launching Windows DepthVista Console Application

1. Extract the **given Package.**
2. **<Extracted Directory>/Windows/Bin/CMD/x64** will contain the DepthVistaConsoleApp.exe file.
3. Double click the DepthVistaConsoleApp.exe

Selecting the Camera Device

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

Figure 1: Application launch screen.

Selecting camera properties

Once the device is selected, camera properties that can be explored will be listed as shown below.

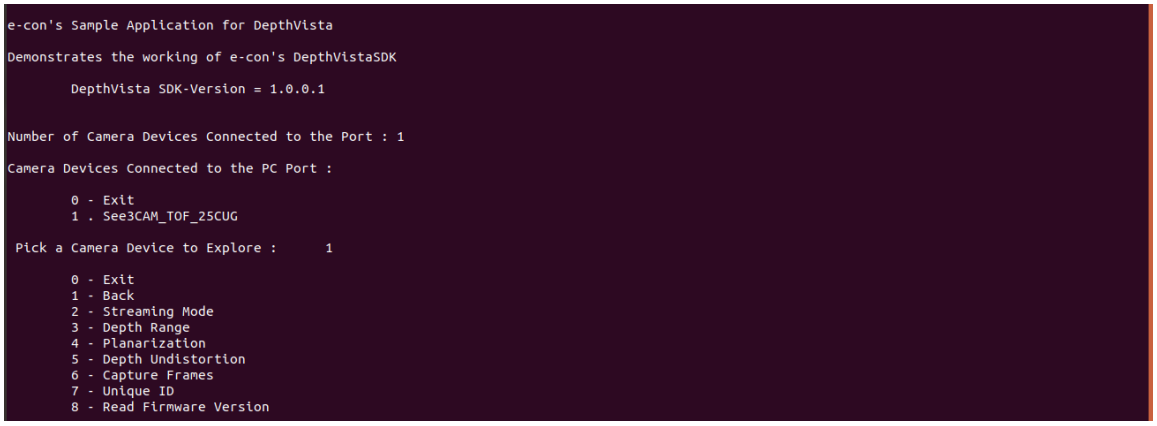

Figure 2: Selecting camera property.

Selecting Streaming Mode

Steps to select the Streaming mode

1. Enter **2** in **Pick a Relevant Choice of Camera Properties** to select the streaming modes.
2. After selecting the Streaming mode option, all the streaming modes supported by the device will be listed as shown below.

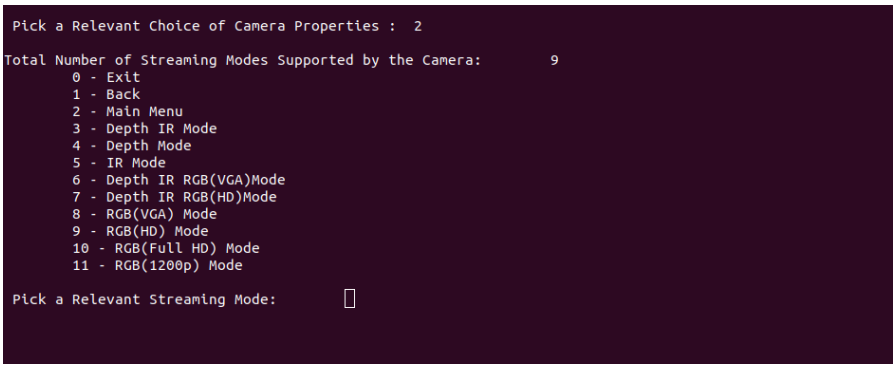

Figure 3: Supported streaming modes.

You can set the streaming mode 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 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, you will get the preview based on the streaming mode as shown

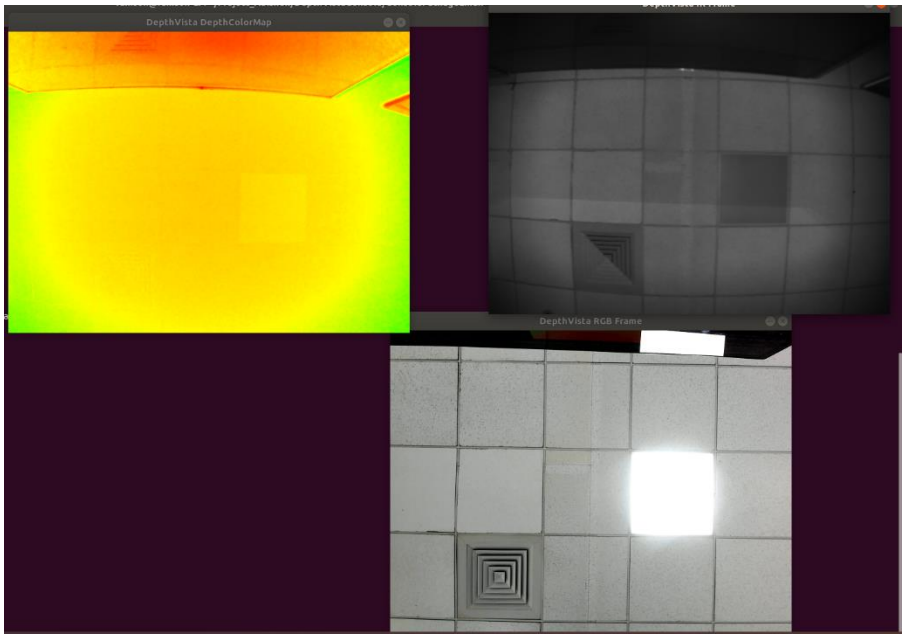

Figure 4: Preview after selecting streaming mode.

Selecting Depth Range

Steps to select the Depth Range

1. Enter **3** in **Pick a Relevant Choice of Camera Properties** to select the Depth range.
2. After selecting the Depth range option, all the depth ranges supported by the device will be listed as shown below.

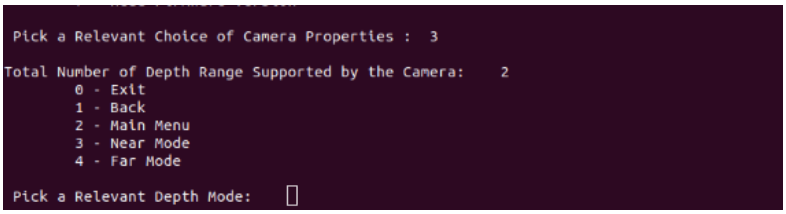

Figure 5: Supported depth ranges.

You can set the depth range 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 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

Steps to select the Planarization

1. Enter **4** in **Pick a Relevant Choice of Camera Properties** to enable and disable planarization.
2. After selecting the Planarization option, you will have the options listed as shown

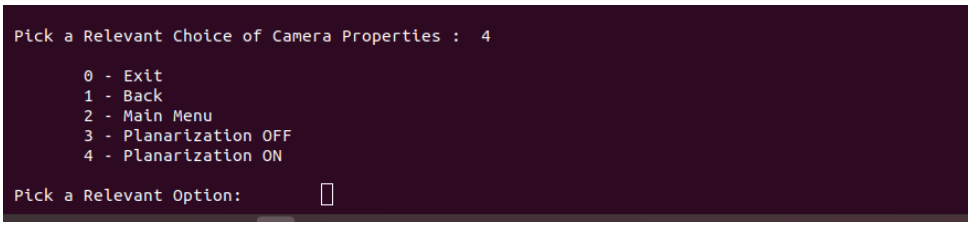

Figure 6: Enabling and disabling Planarization.

You can set the planarization 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 Planarization

- Option **4** to Enable Planarization.

After selecting the preferred planarization, streaming will be updated.

Setting Undistortion

Steps to select the Undistortion

3. Enter **5** in **Pick a Relevant Choice of Camera Properties** to enable and disable Undistortion.
4. After selecting the Undistortion option, you will have the options listed as shown

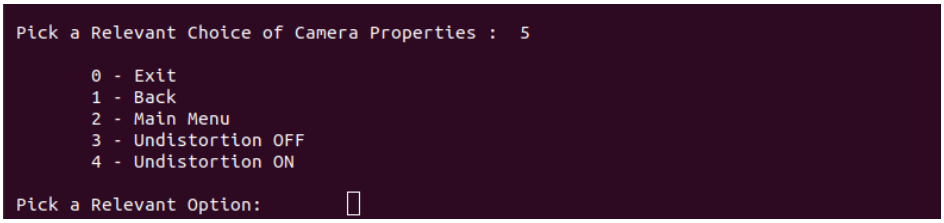

Figure 7: Enabling and disabling Planarization.

You can set the planarization 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

Steps to capture frames

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

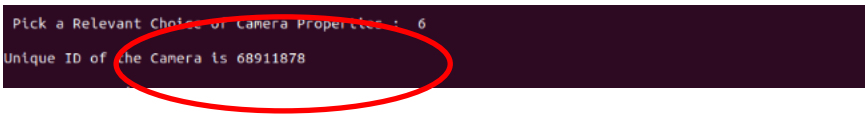

Figure 9: Reading Unique ID of the device.

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 the device.

Exiting the application

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

Troubleshooting

1. **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.

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

   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.

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

   You need to install the latest version of DepthVista sample application from the Developer Resources website.

4. **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.

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

   Run the following command in terminal

   ```
   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?**

   External Power Supply

   Input: AC 100-240v, 50/60HZ

   Output: DC 12V, 4A

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

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

4. **What's 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 is pre-calibrated?**

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

9. **What's 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 synchornized?**

    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 6dof (degree of freedom) IMU (Inertial Measurement Unit) featured with triaxial accelerometer and triaxial gyroscope, supports different modes of configuration.

12. **Why this camera is 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's 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?**

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_Linux.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?**

    Windows 10 and Ubuntu 18.04.

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's 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 user is 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 Console Windows Installation Manual*
- *DepthVista Console Linux Installation Manual*

Glossary

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