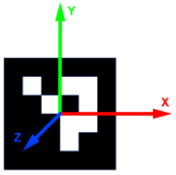
3D Displacement Measurement using ARUCO Marker

User Guide



Developed By: AGCAM - SITL

Contact Name: Jongwoong Park

Contact Email: smart.jwp@gmail.com

Contact Phone: +82-10-3167-3275

Overview

This is the user manual for the 3D displacement measurement toolkit utilizing GigE cameras and aruco marker.

Requirements

The following are the system's specifications:

1. Desktop Computer System (Intel Core i5, 8GB, 256GB)
2. Gigabit Ethernet GigE Machine Vision Industrial Camera (MS-GE40GC-T 0.4MP 298fps)
3. Quad Network Interface Card (I340-T4 Network Card Intel 1000Mbps)
4. Ubuntu 20.04 LTE with ROS Noetic

Working Instructions

The following describe the working of the system:

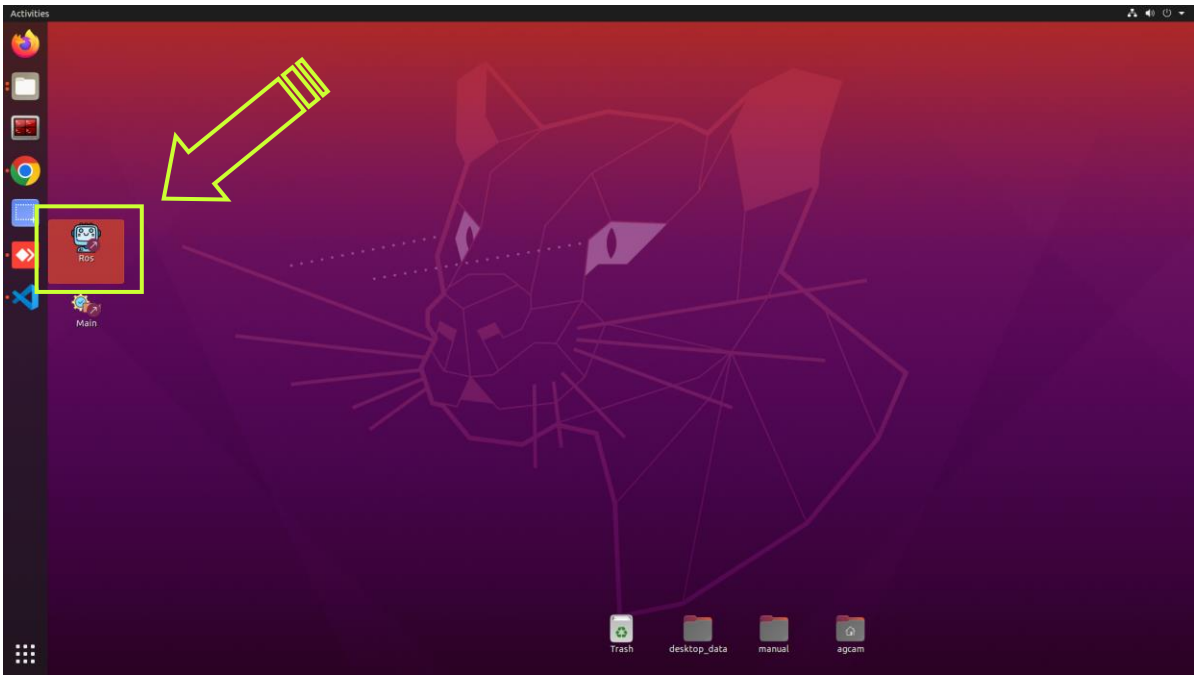
1. Ros Initialization
2. Store camera video stream for post processing
3. Displacement calculation using post processing of stored video stream data.

Following is a comprehensive description of the preceding steps:

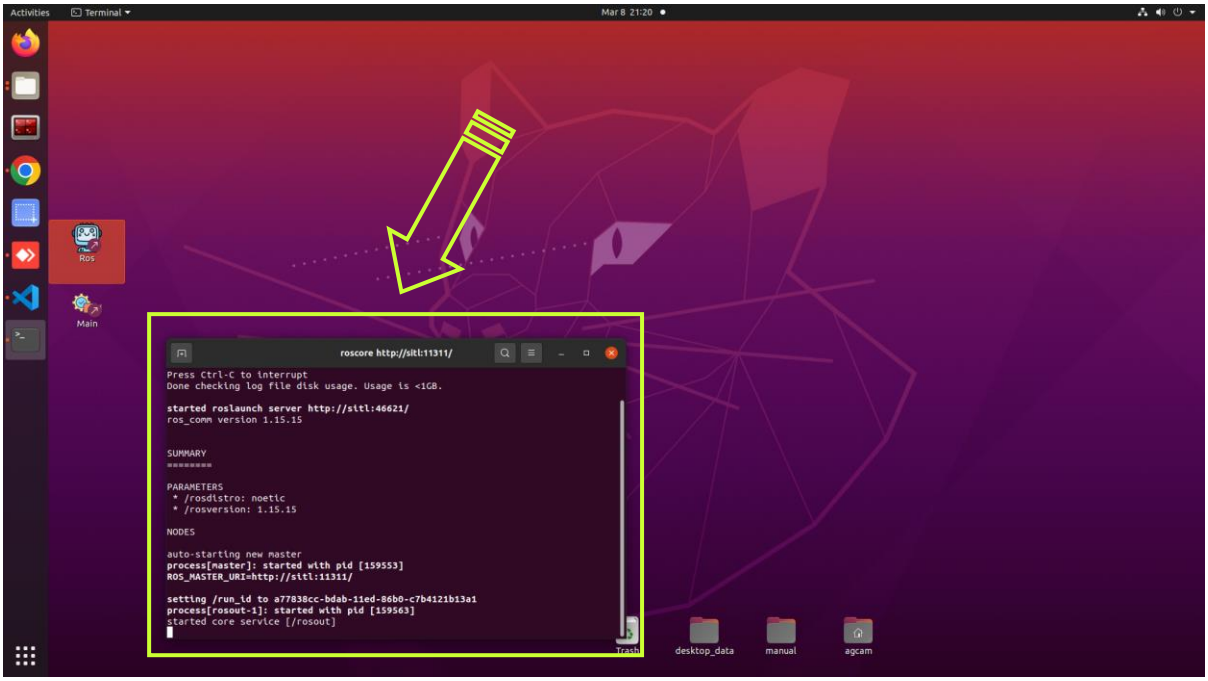
Step No. 01: ROS Initialization

The following steps are required for every ROS-compatible program:

1. Initialize the **ROS node** by pressing the **Ros** desktop icon ( ) as shown in the following figure:



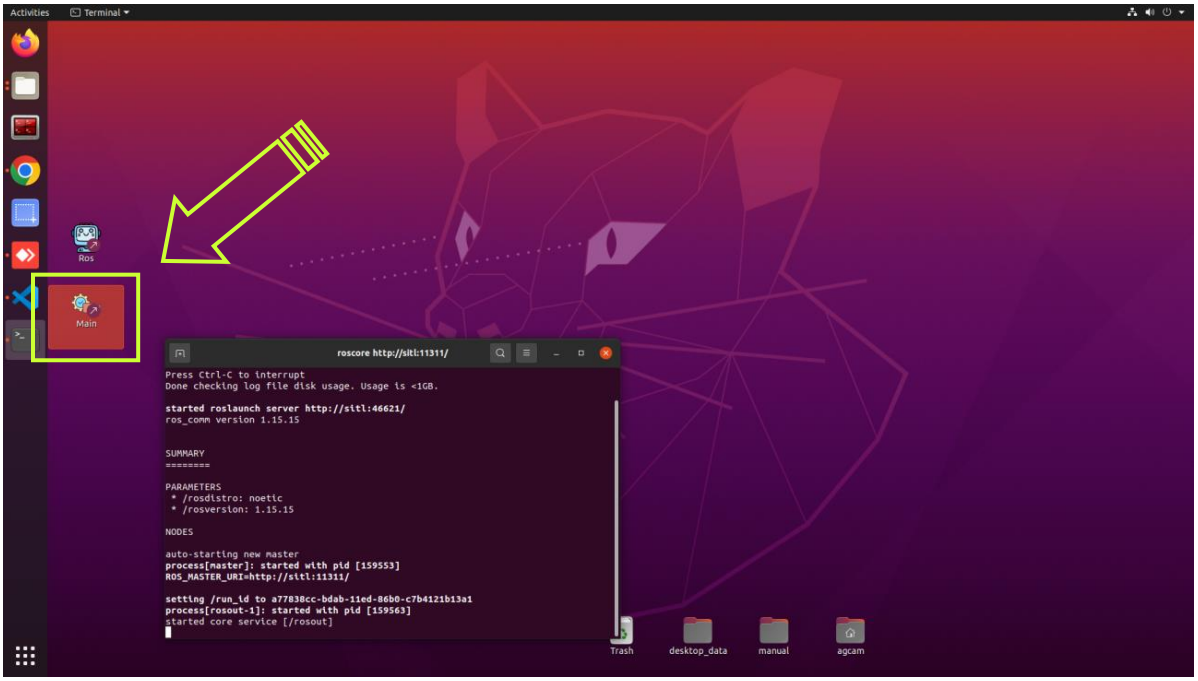
2. The **ROS node** is now operational, as illustrated in the following figure:



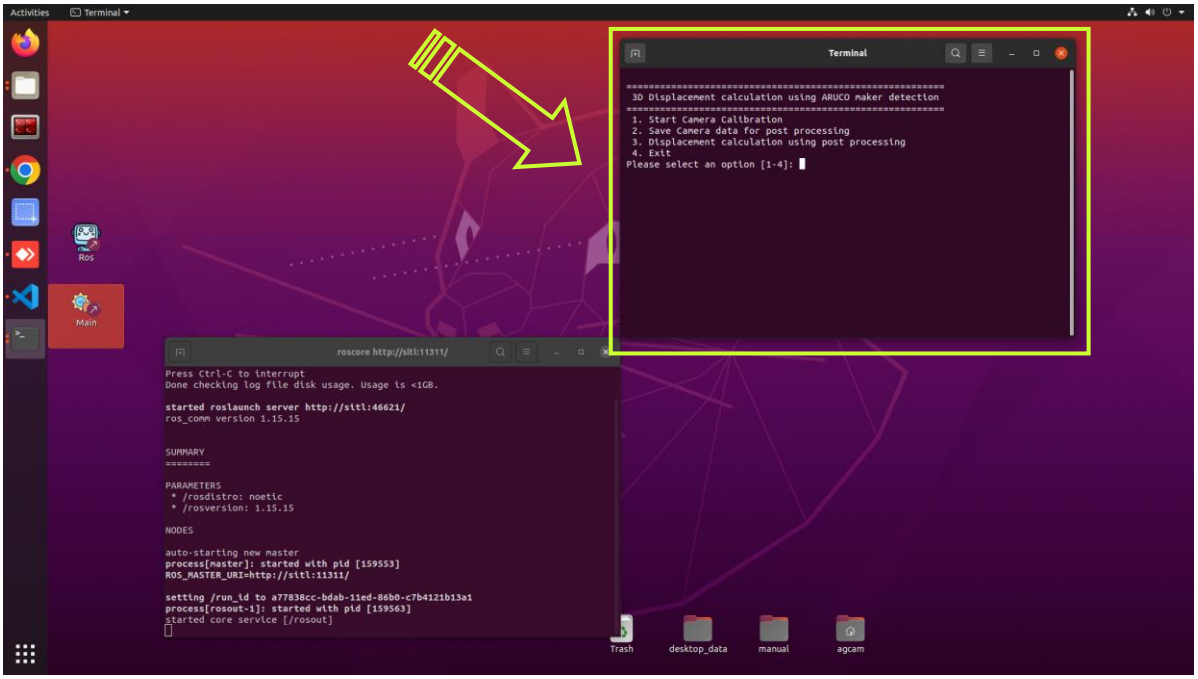
3. Next, we will launch our main program.

Step No. 02: Main Program Initialization

1. Initialize the **Main program** node by pressing the **Main** desktop icon () as shown in the following figure:



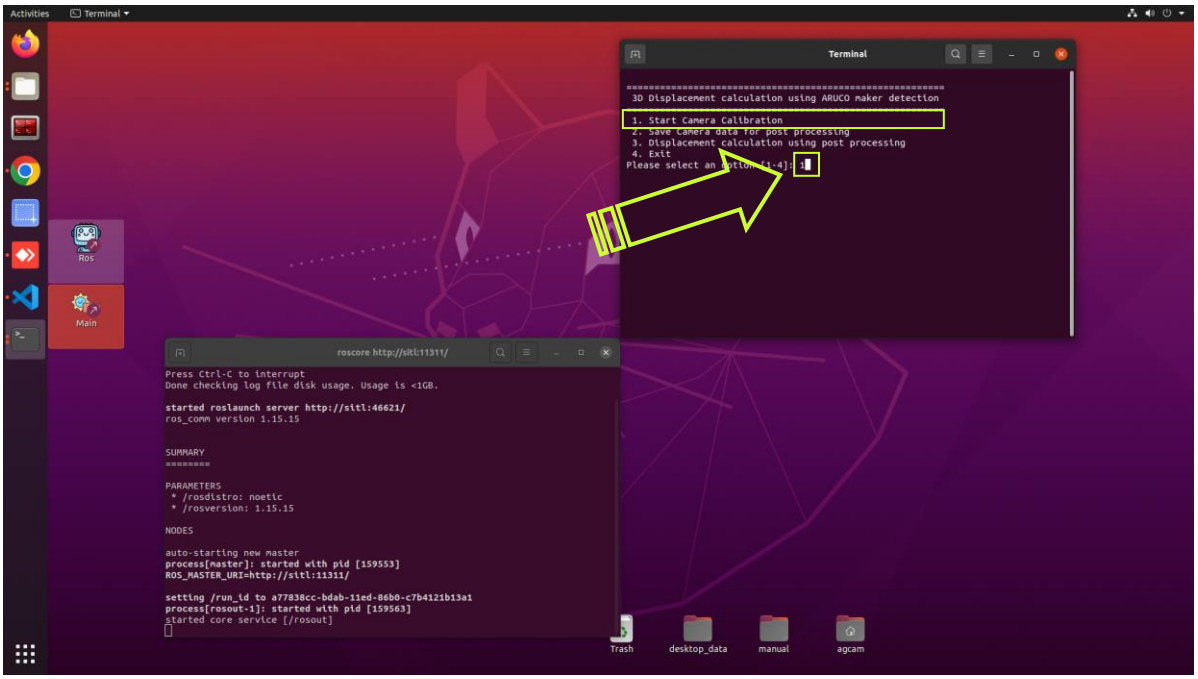
2. Now the ***Main program*** node is running, as showing in the following figure:



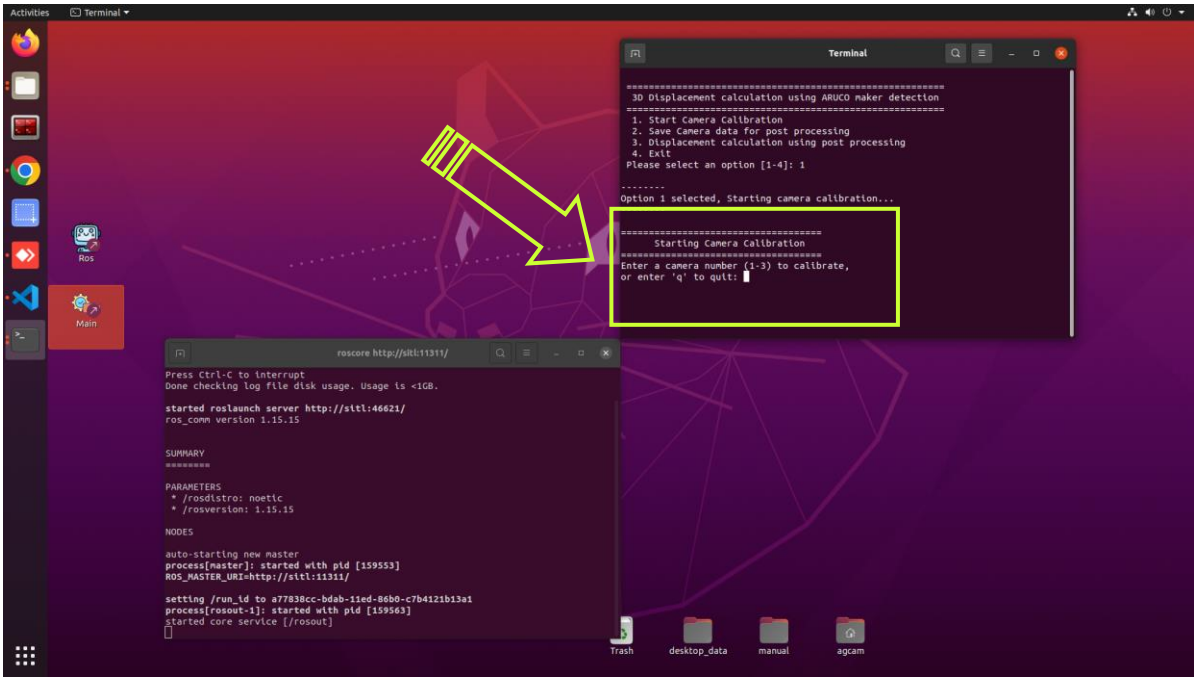
3. Now we may proceed to the next steps.

Step No. 03: Camera Calibration

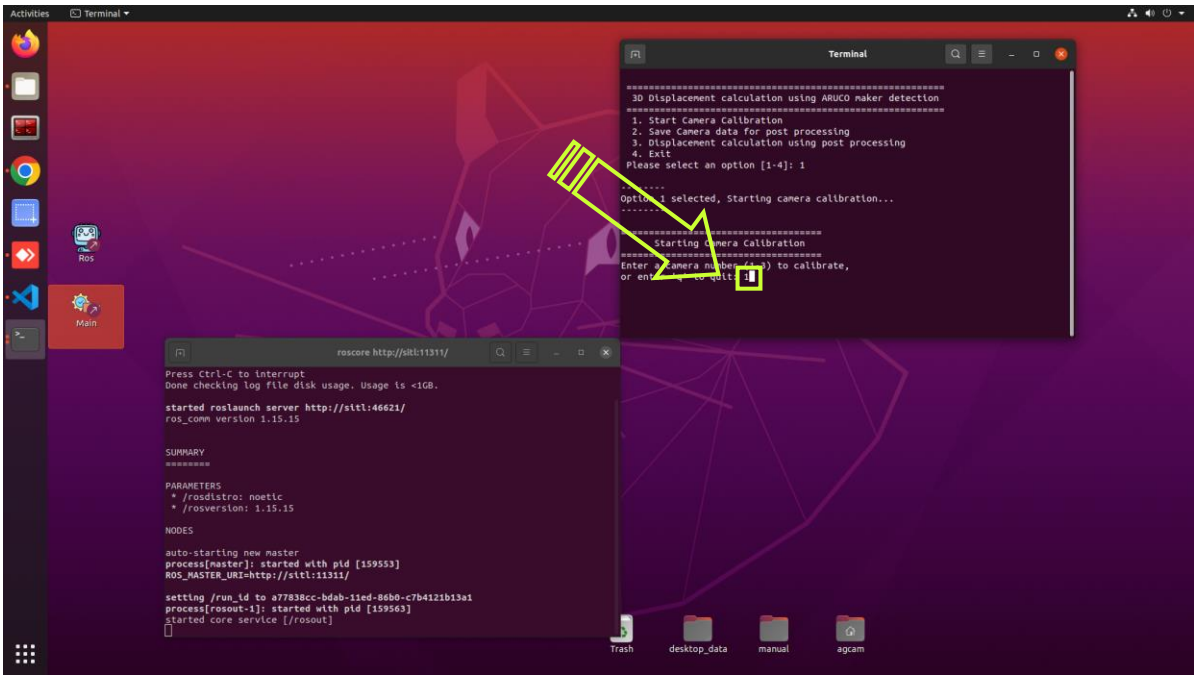
1. Please select option "**1**" to begin **Camera Calibration**, as depicted in the figure below:



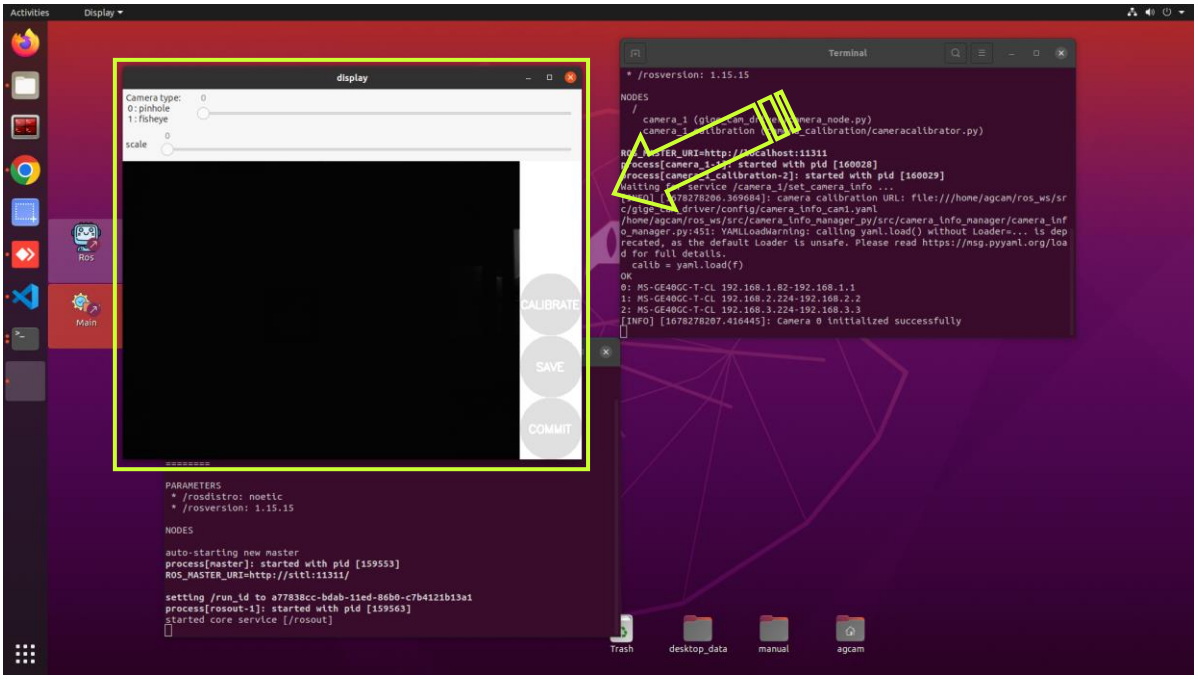
2. The **Camera Calibration** process has started as depicted in the figure:



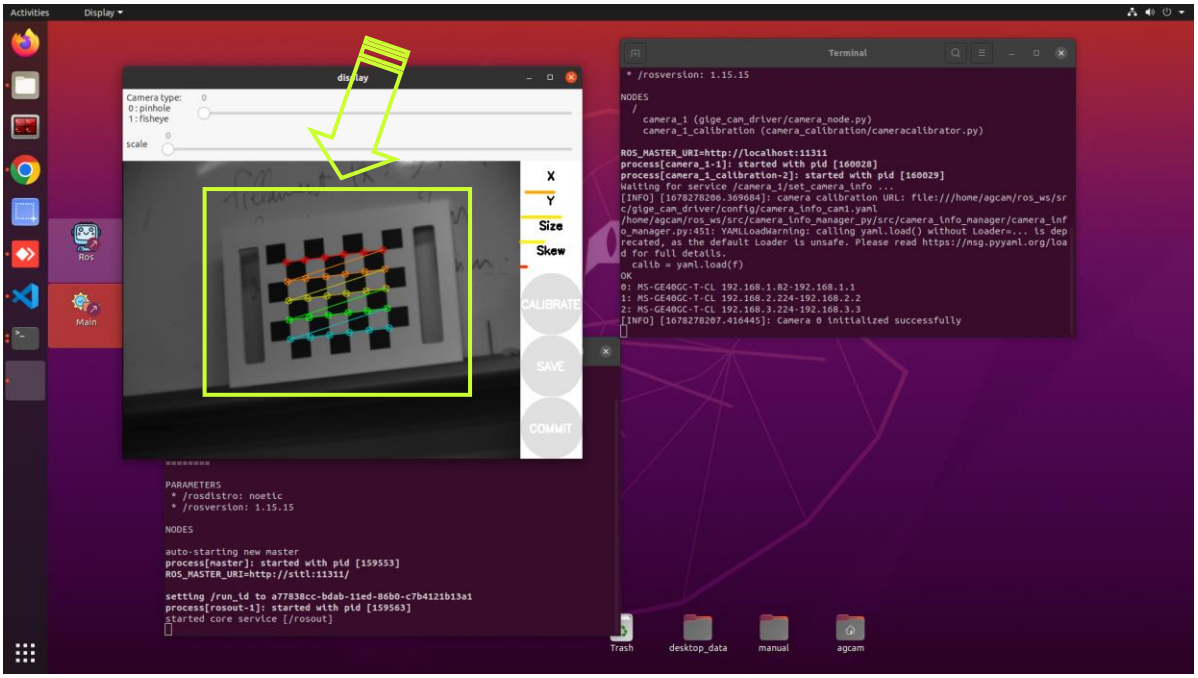
3. Please select "**1**" to calibrate **Camera 1**, as depicted in the figure below:



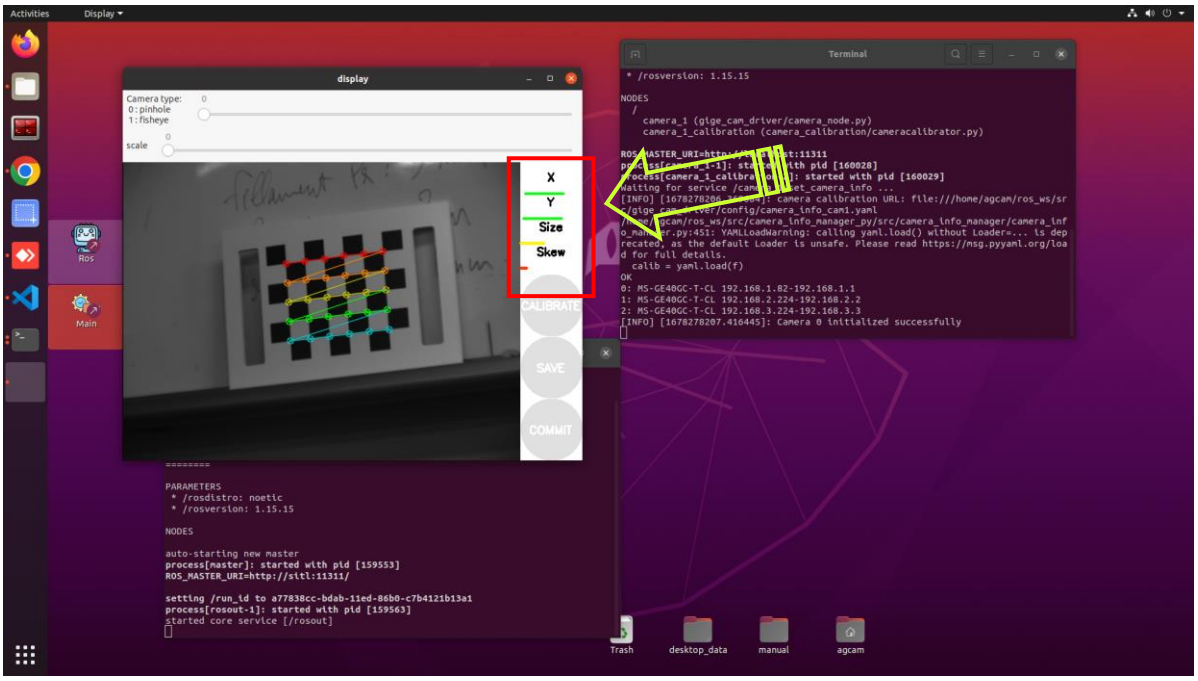
4. The **Camera Calibration** window will launch as depicted in the following figure:



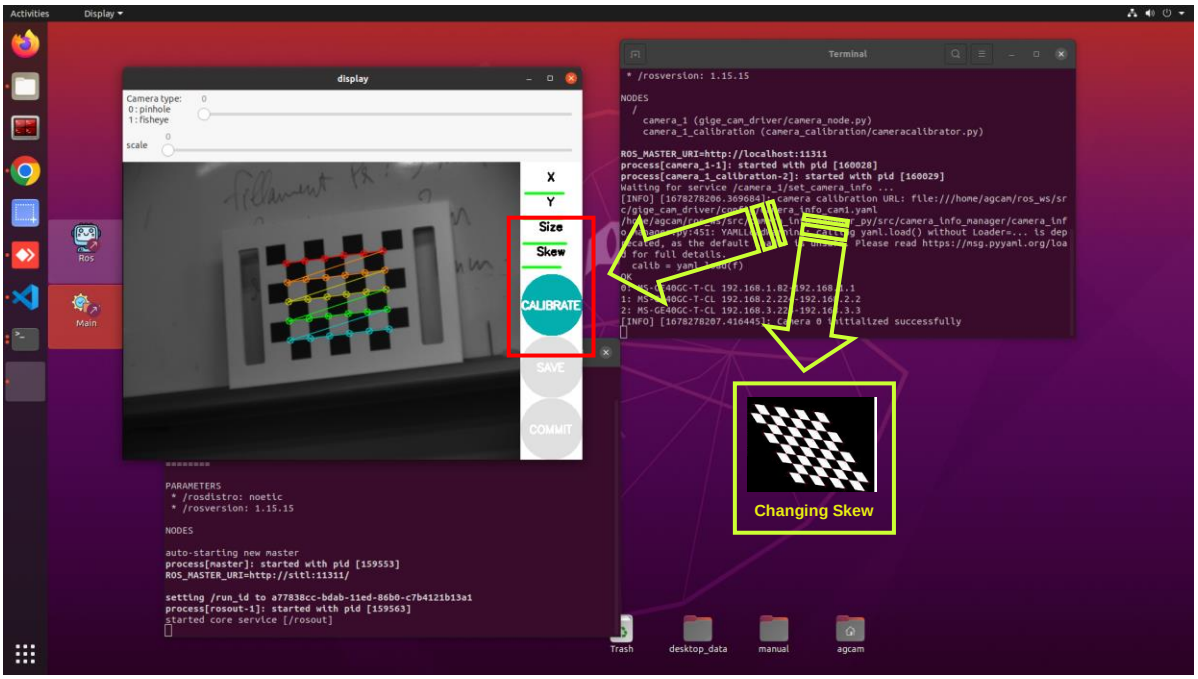
5. Place a **6x4 Checkerboard** in front of the **Camera 1** to initiate the **Calibration** process. As depicted in the figure below, if the checkerboard is identified, a **colorful pattern** will appear:



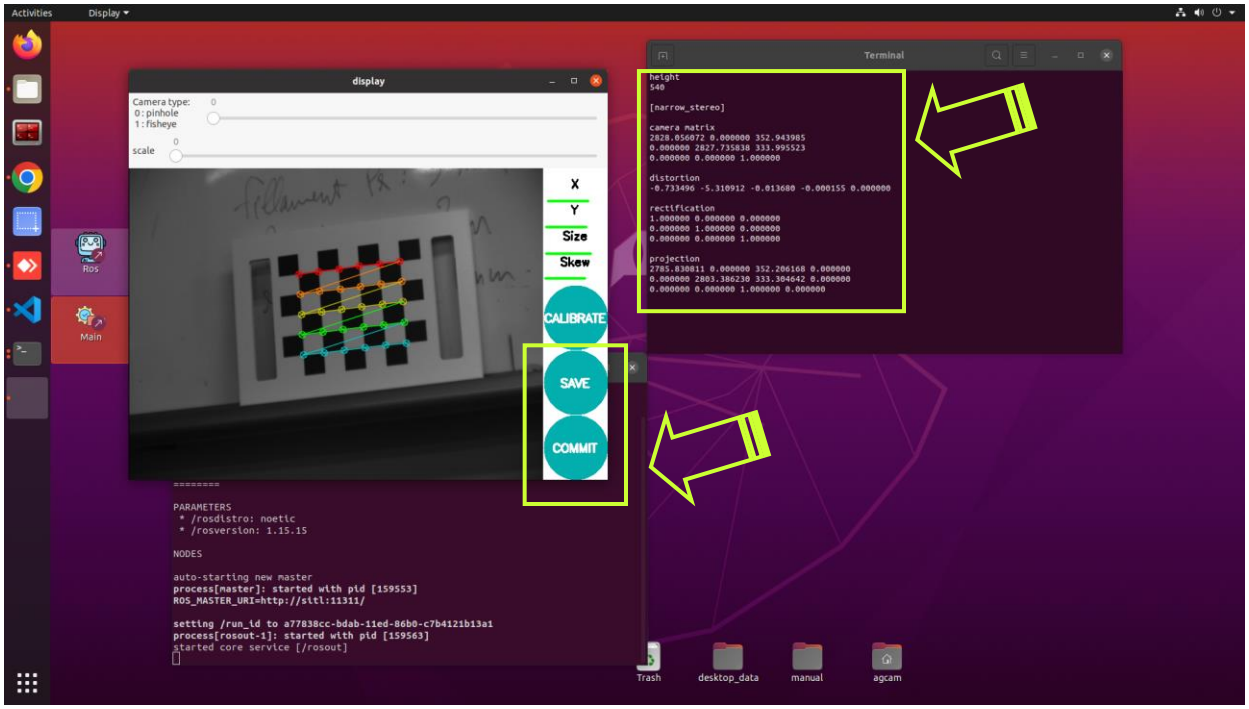
6. Move the **Checkerboard** in horizontal and vertical directions until the bars below **X** and **Y** turn **Green**, as depicted in the figure below:



7. Move the **Checkerboard** towards and away from the camera for **Size** adjustment, and turn diagonally (changing roll, pitch, and yaw axis) for **Skew** adjustment, until the bars below **Size** and **Skew** turn **Green** and the **CALIBRATE** button also turns **Green**, as shown in the figure below:



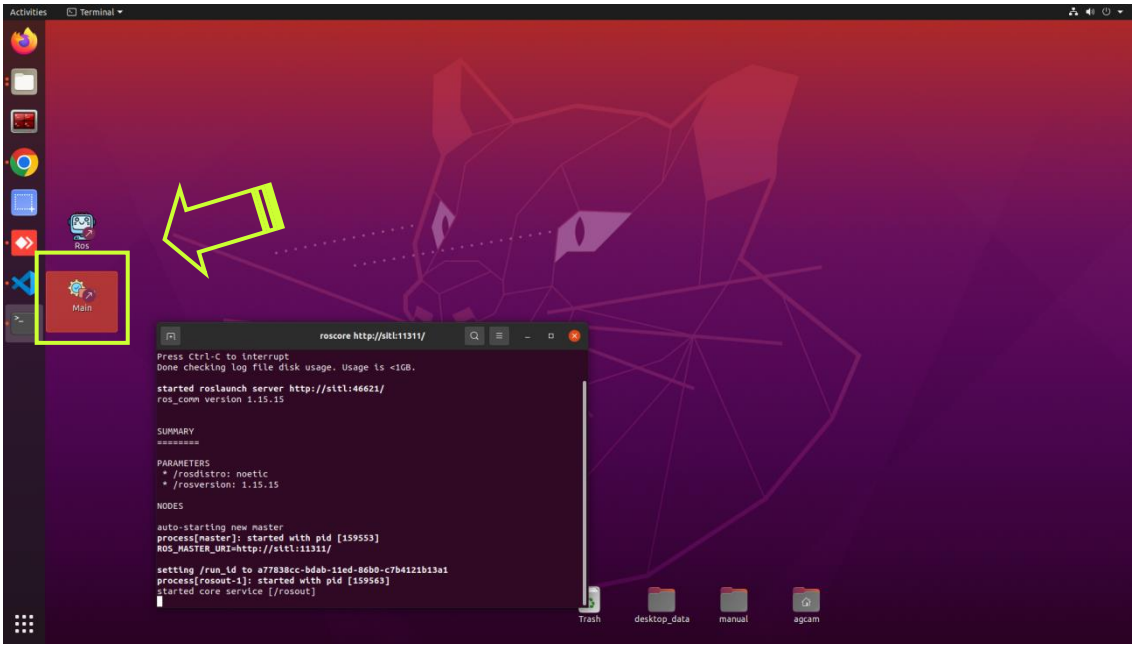
8. Press the **SAVE** button to save the camera parameters and calibration images, then press the **COMMIT** button to conclude the **Camera Calibrating** procedure. The terminal screen will display the camera's parameters as shown below:



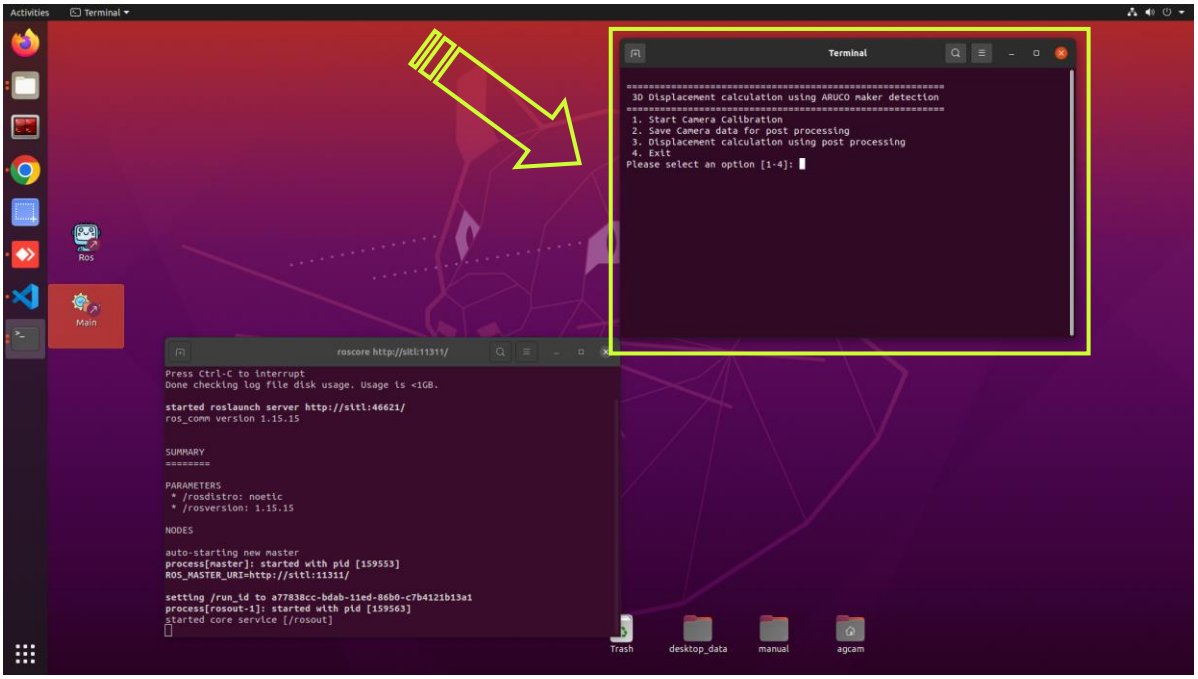
9. Camera Calibration has completed successfully, close the terminal window and now we may proceed to the next steps.

Step No. 04: Storing Camera Data for Post Processing

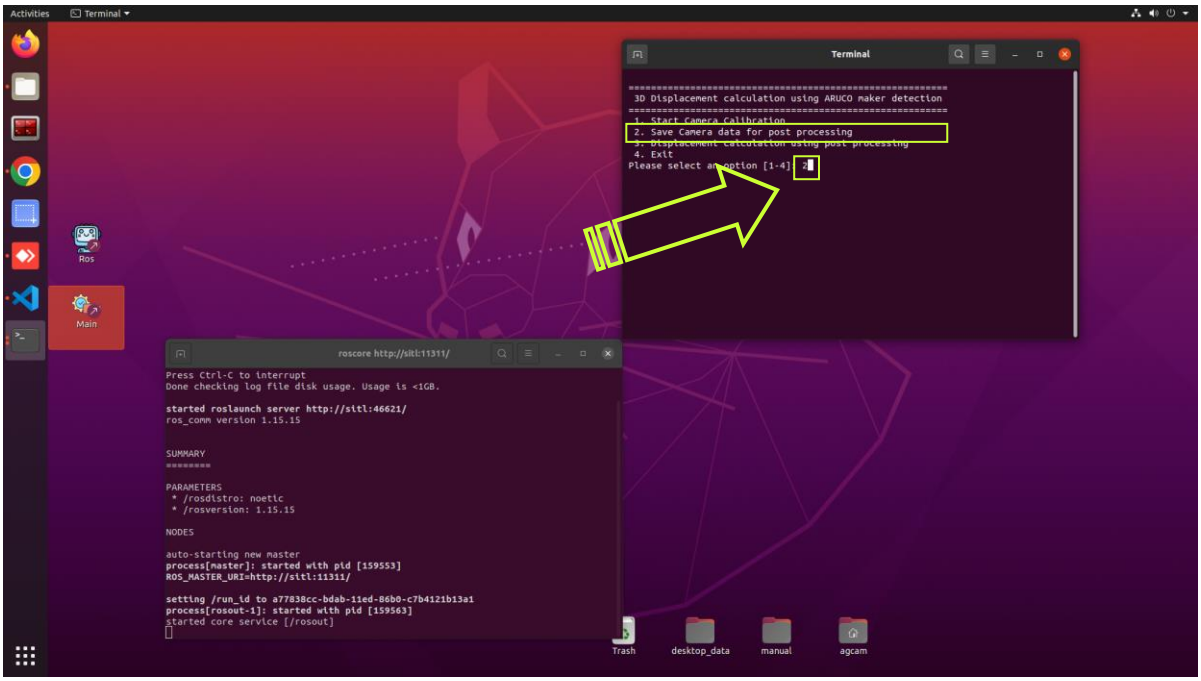
1. Initialize the **Main program** node by pressing the **Main** desktop icon () as shown in the following figure:



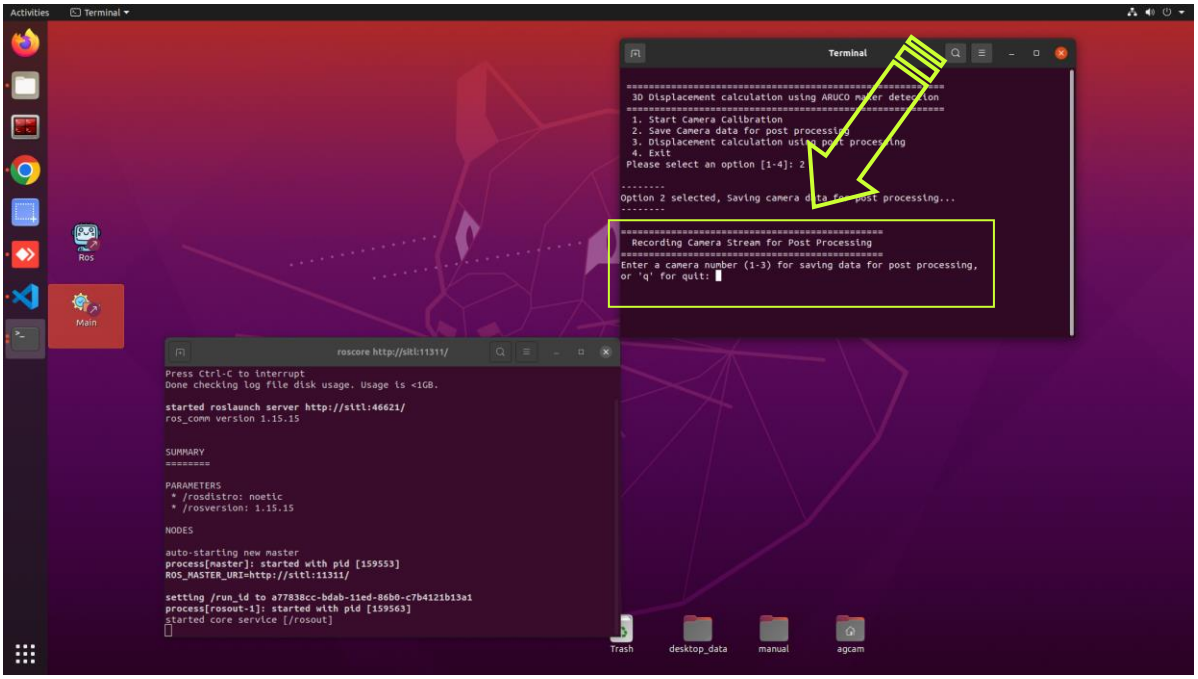
2. Now the ***Main program*** node is running, as showing in the following figure:



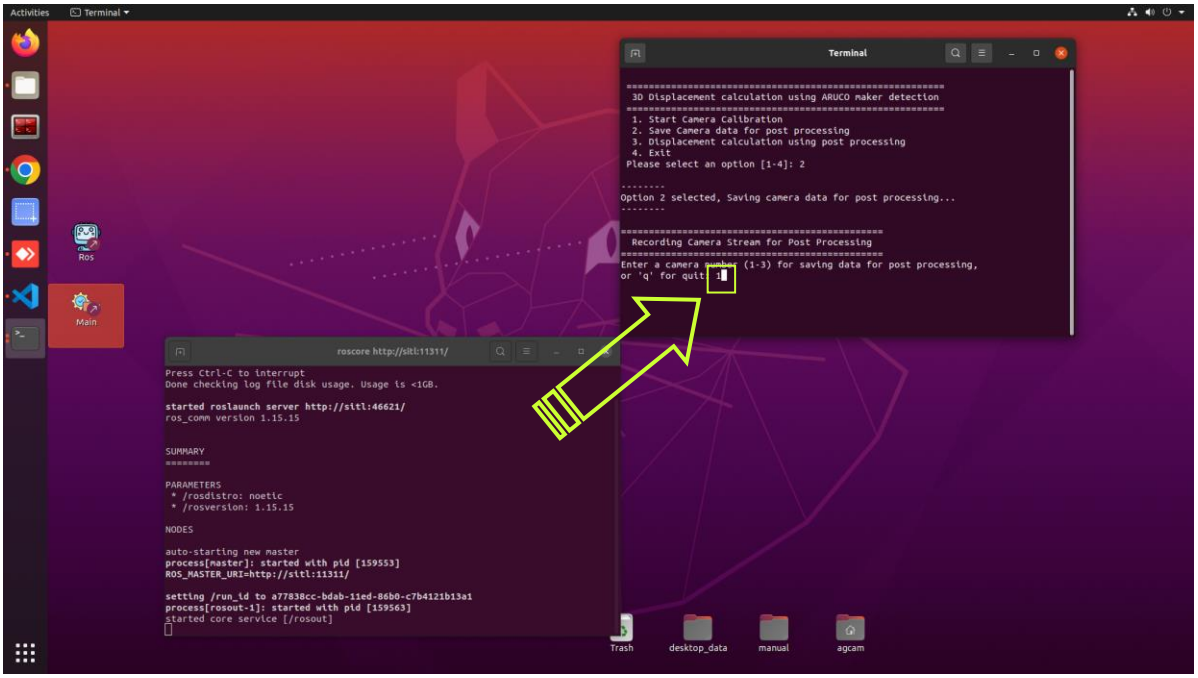
3. Now select option "**2**" to **store** camera data for **Post Processing**, as depicted in the figure below:



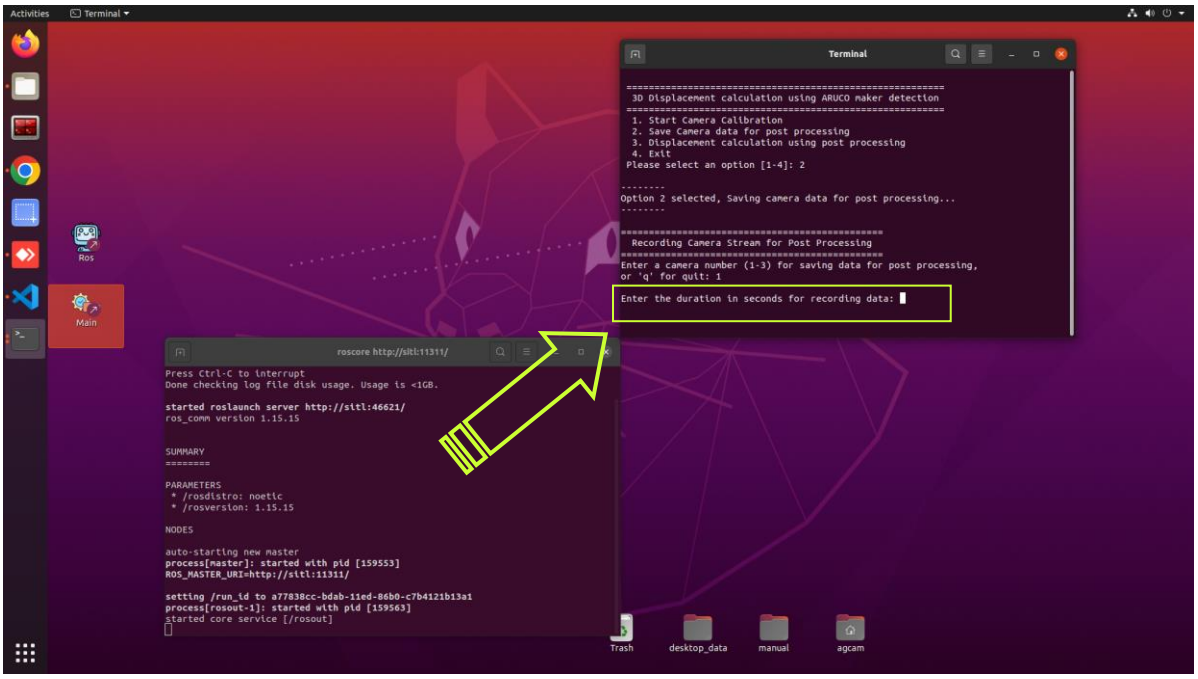
4. The **Storing Camera Data** process has started as depicted in the figure:



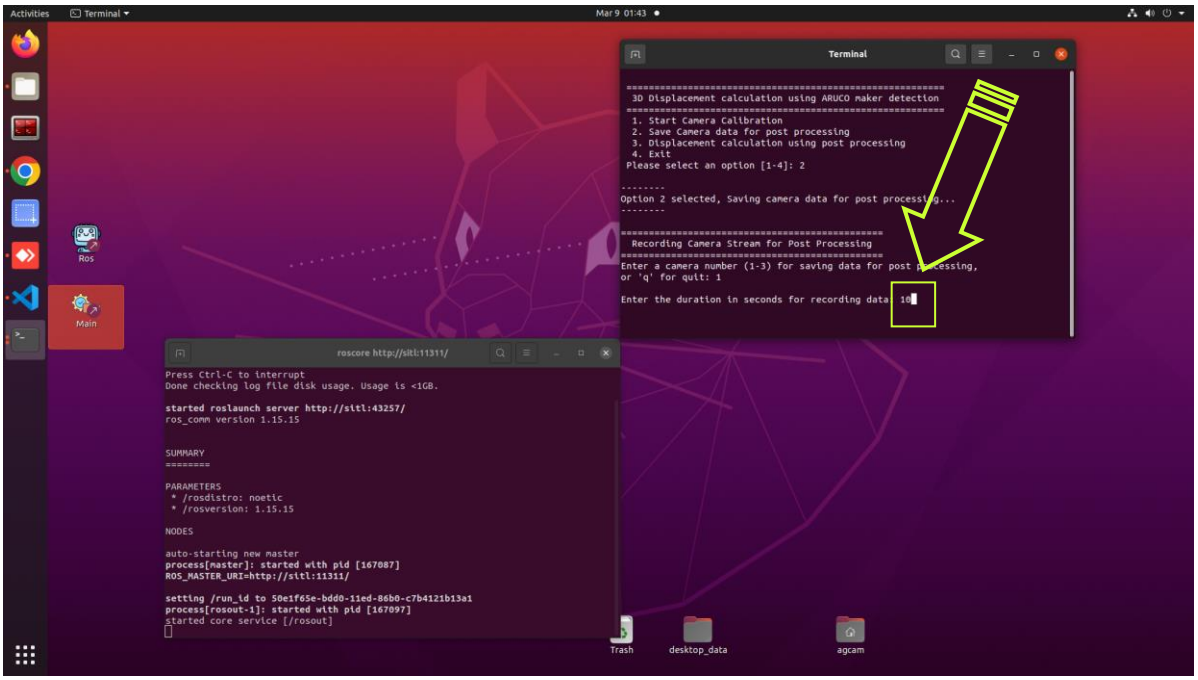
5. Please enter "1" to record the camera stream from **Camera 1** for post-processing, as shown in the figure below:



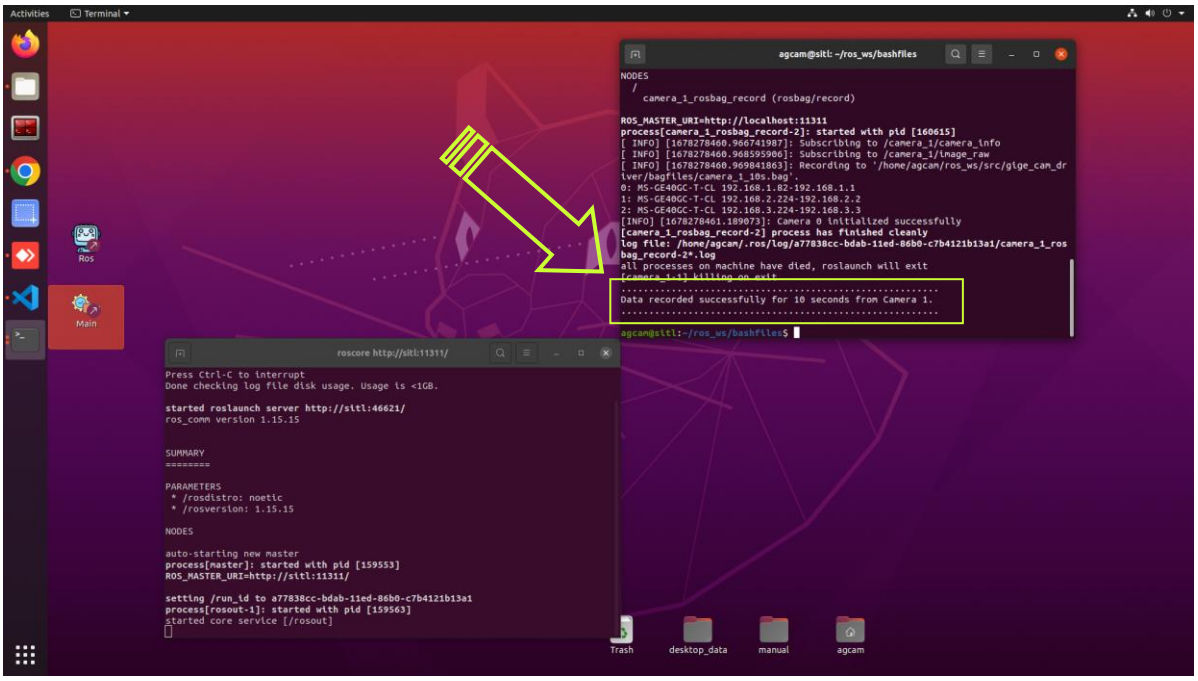
6. Enter the duration for which the camera data should be recorded for post-processing from Camera 1.



7. Please enter "**10**" to capture 10 seconds of video stream from **Camera 1** for post-processing, as depicted in the figure below:



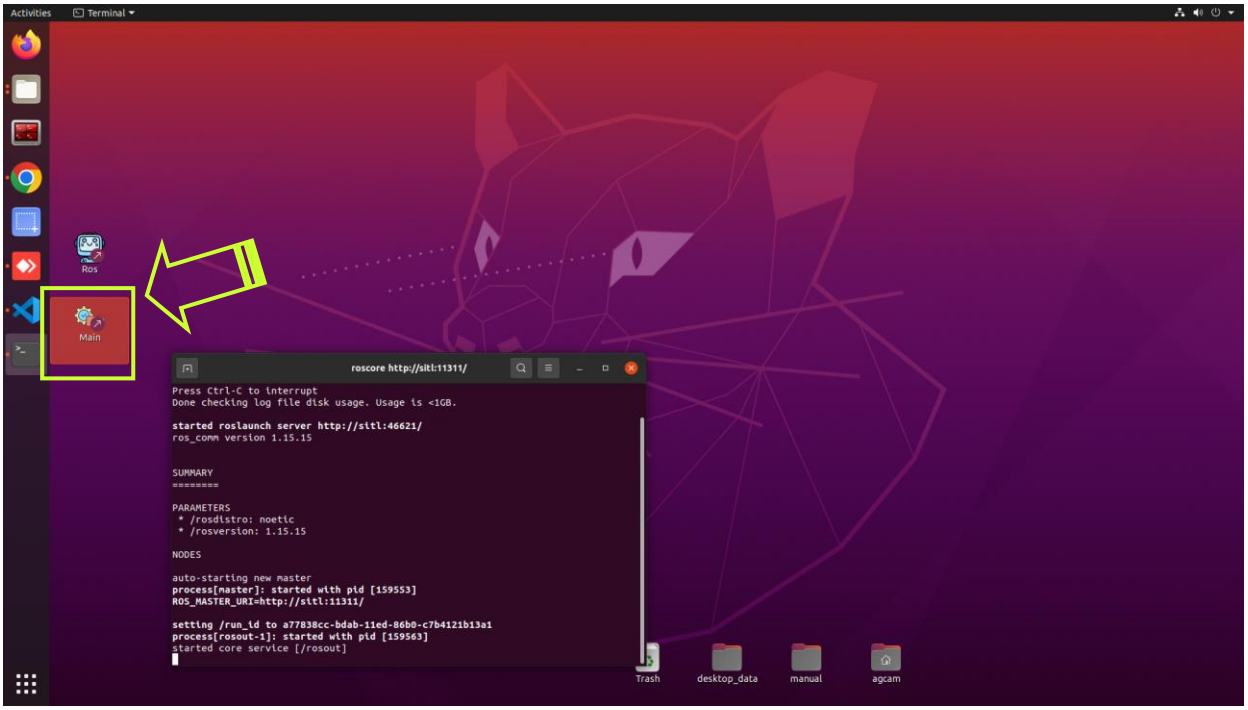
8. Now a 10 seconds of video stream from **Camera 1** for post-processing has been successfully saved as shown in the following figure:



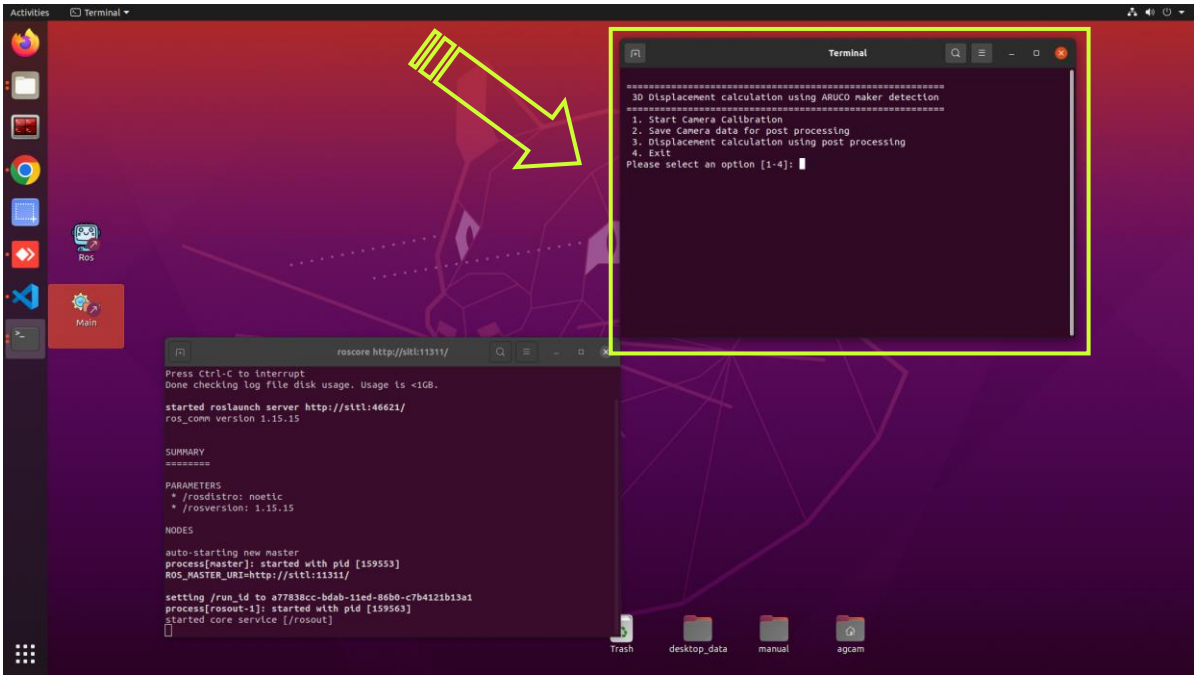
9. Now you may close the terminal window and proceed to the next step.

Step No. 05: Post Processing from Saved Camera Data

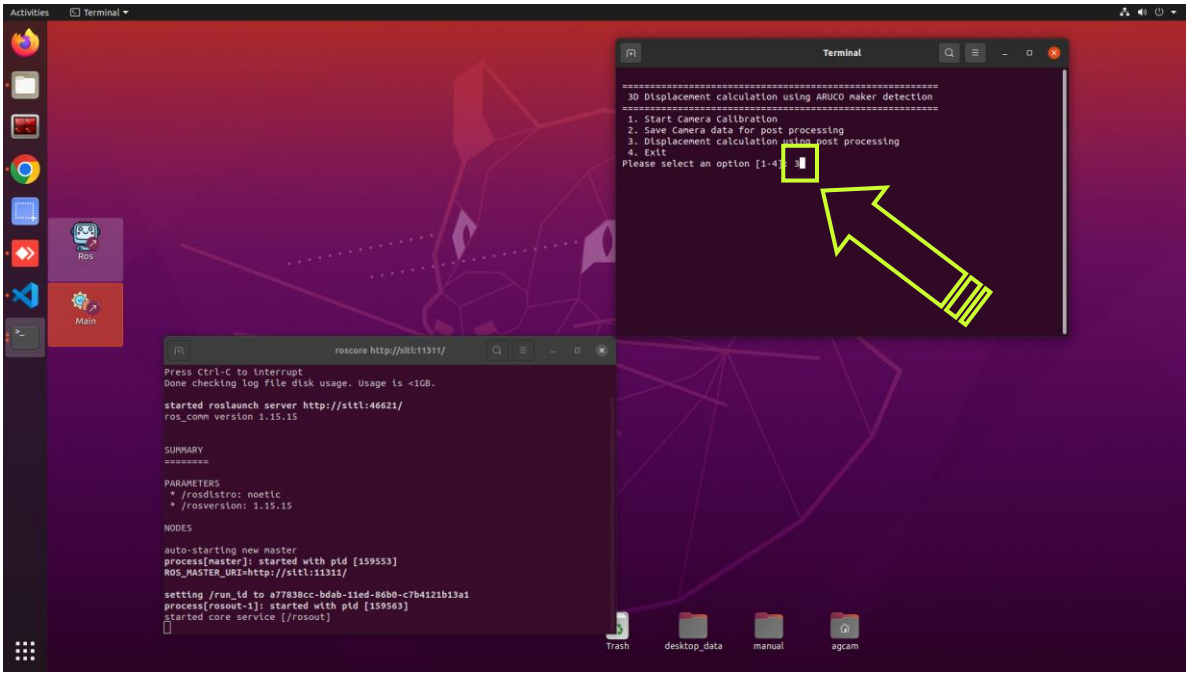
1. Initialize the **Main program** node by pressing the **Main** desktop icon () as shown in the following figure:



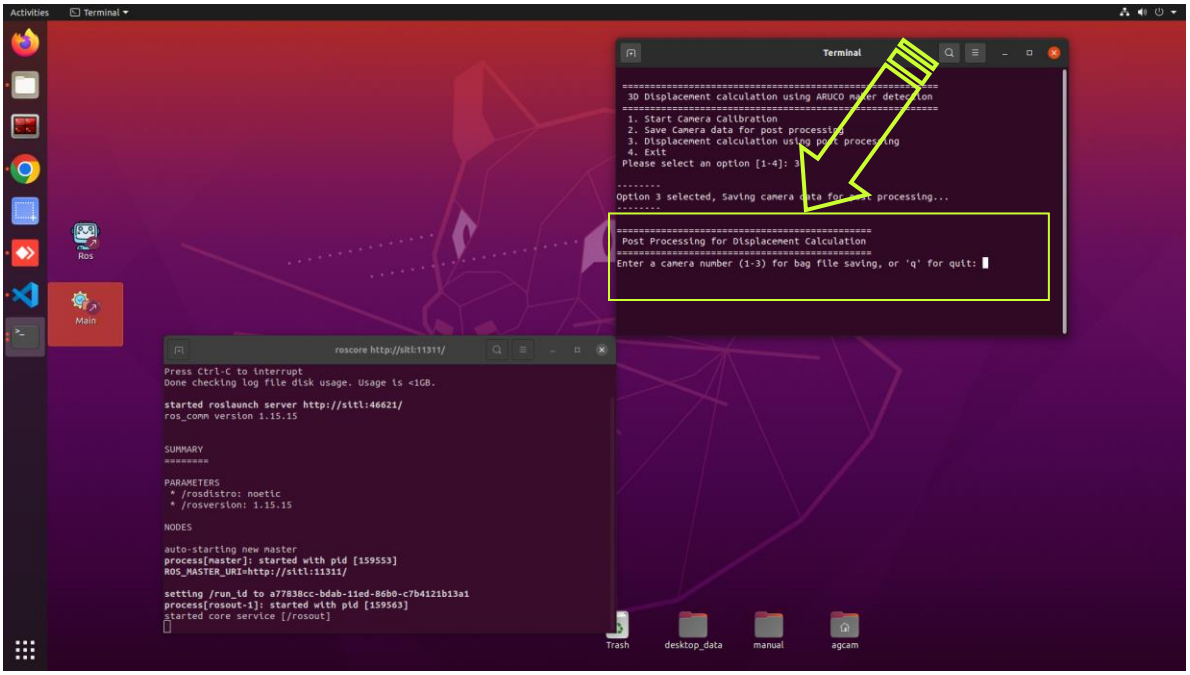
2. Now the ***Main program*** node is running, as showing in the following figure:



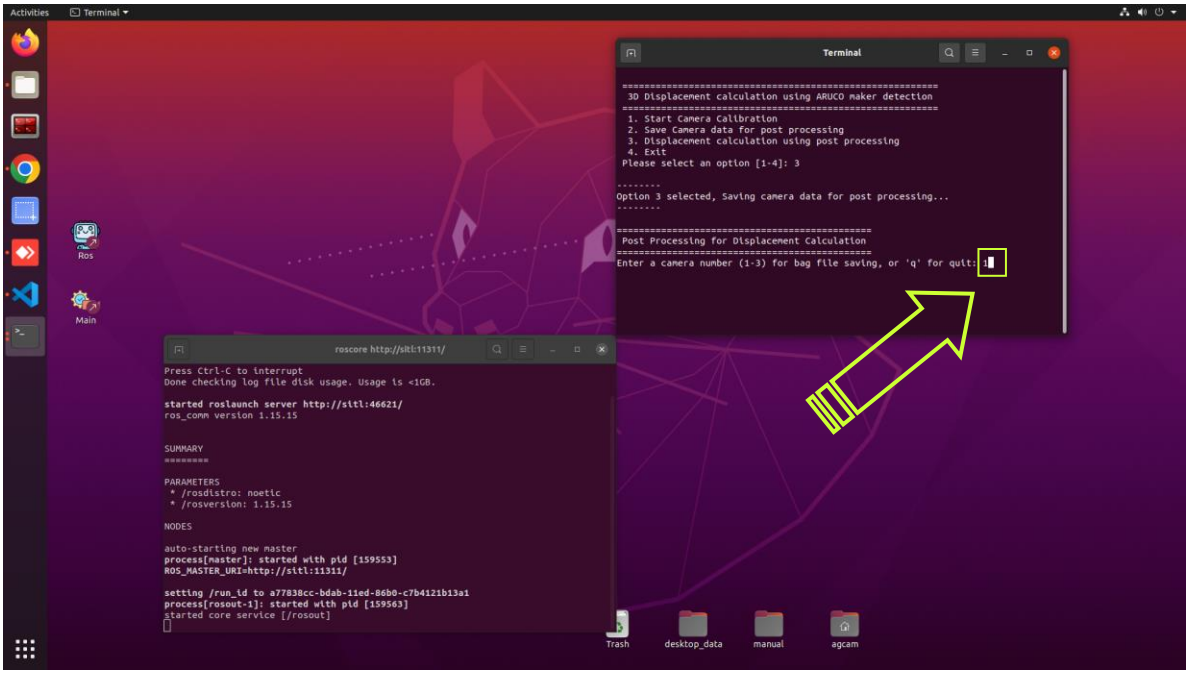
3. Now select option "**3**" to start **Displacement Calculation** from camera data, as depicted in the figure below:



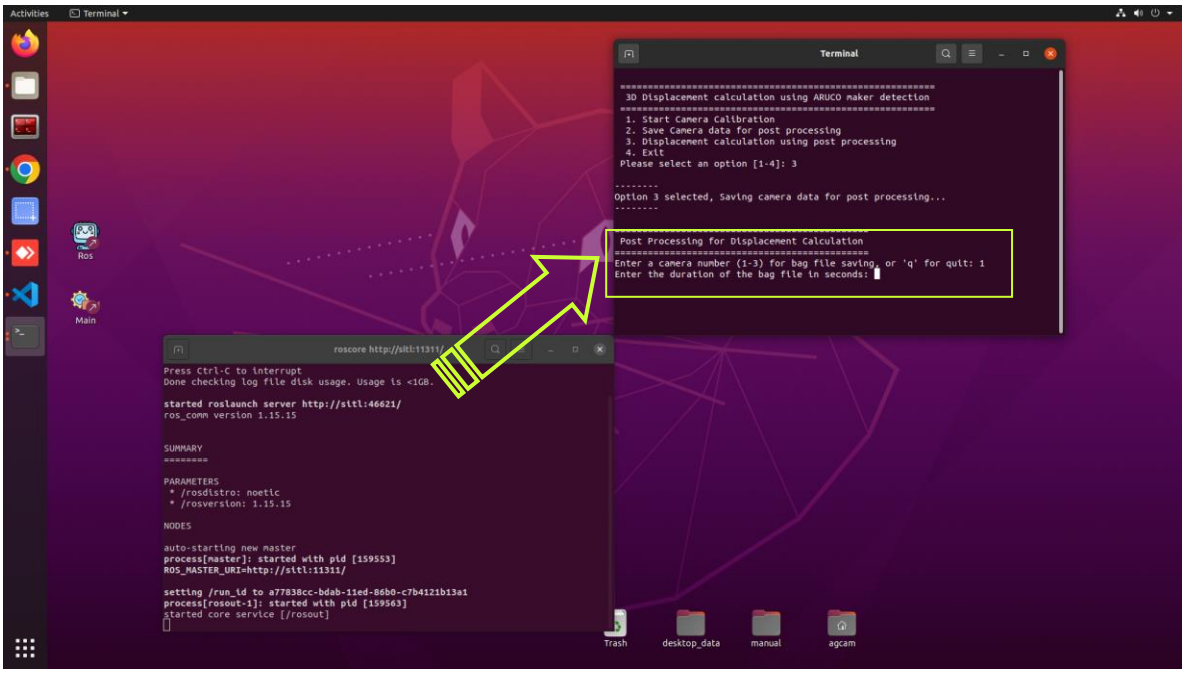
4. The **Displacement Calculation** process has started as depicted in the figure:



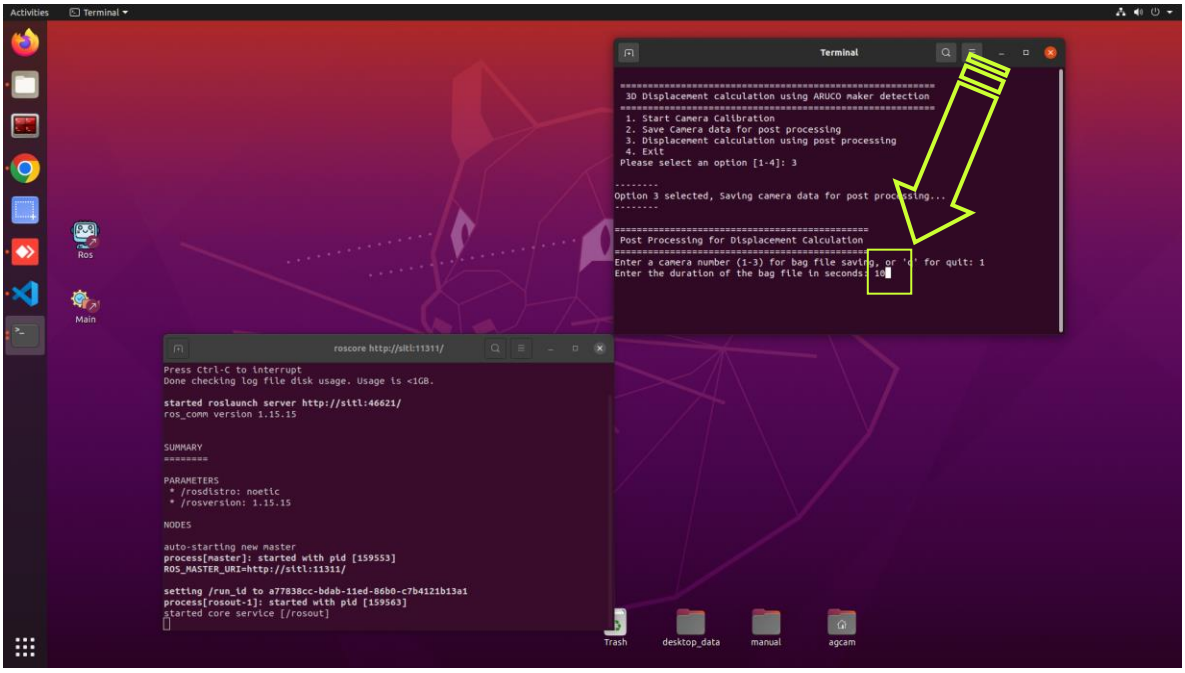
5. Please enter "1" to use the **Camera 1** recorded stream for post-processing, as shown in the figure below:



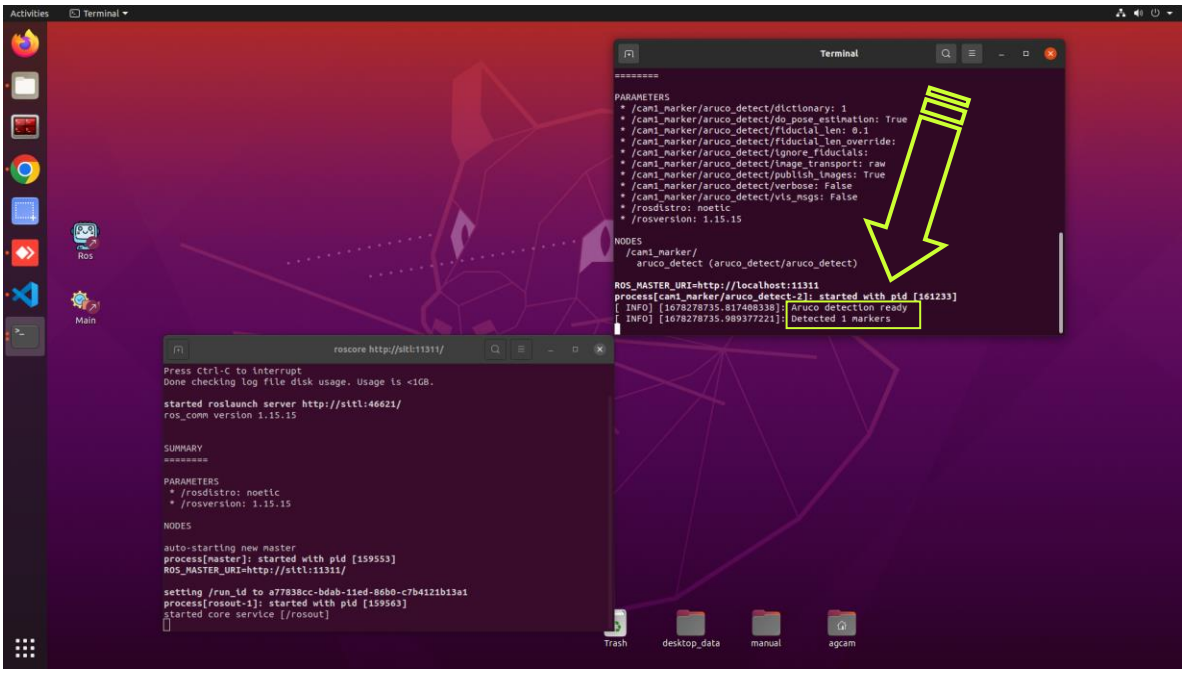
6. Enter the duration of the stored video stream from **Camera 1** to be used for post-processing, as depicted in the figure below:



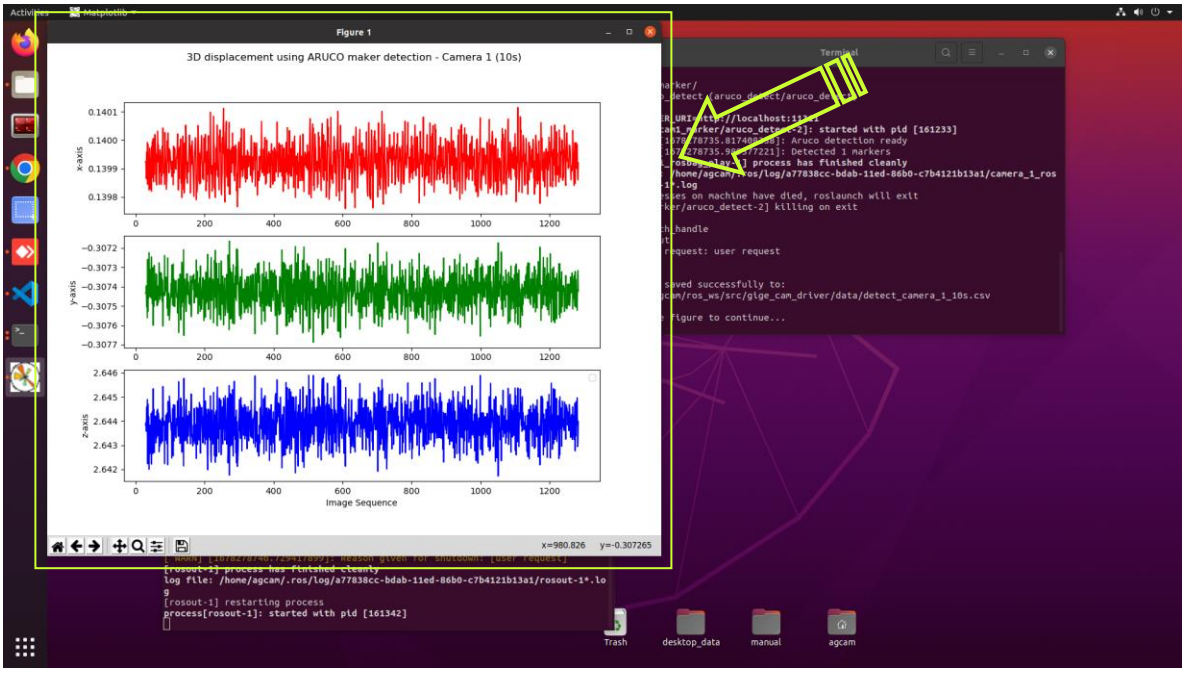
7. Please enter "**10**" to use 10 seconds video stream stored from **Camera 1** for post-processing, as depicted in the figure below:



8. The following figure demonstrates that the **ARUCO marker** is **detected** in the video captured by **Camera 1**:

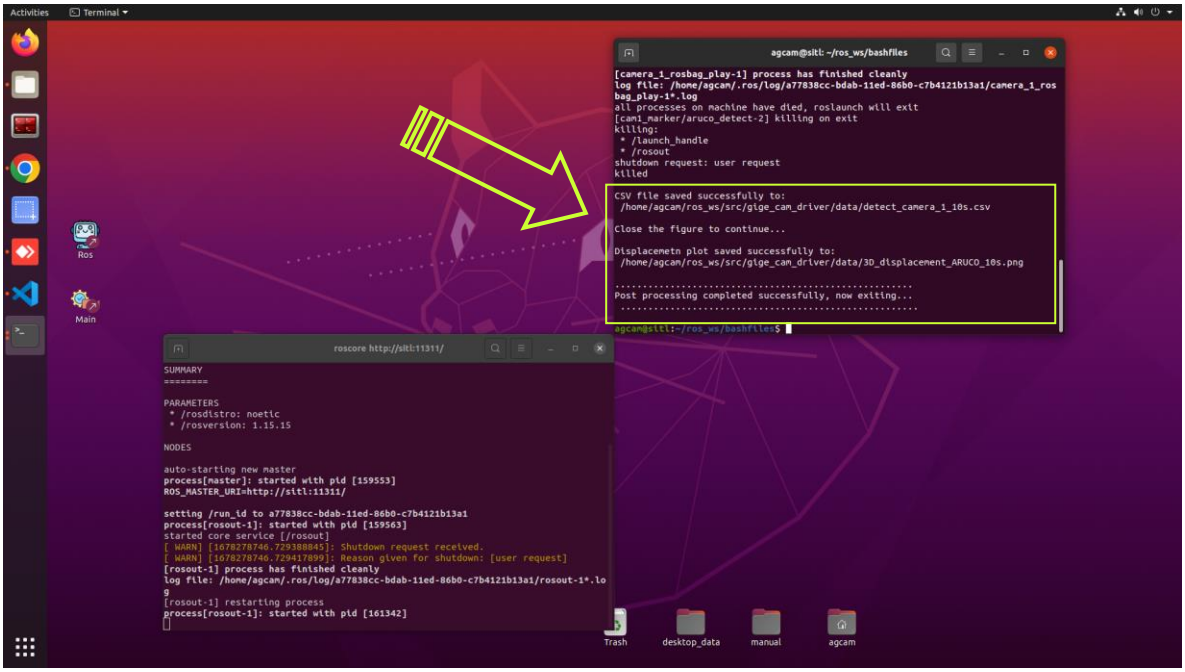


9. The **three-dimensional displacement** plots are then displayed as shown in the subsequent figure:

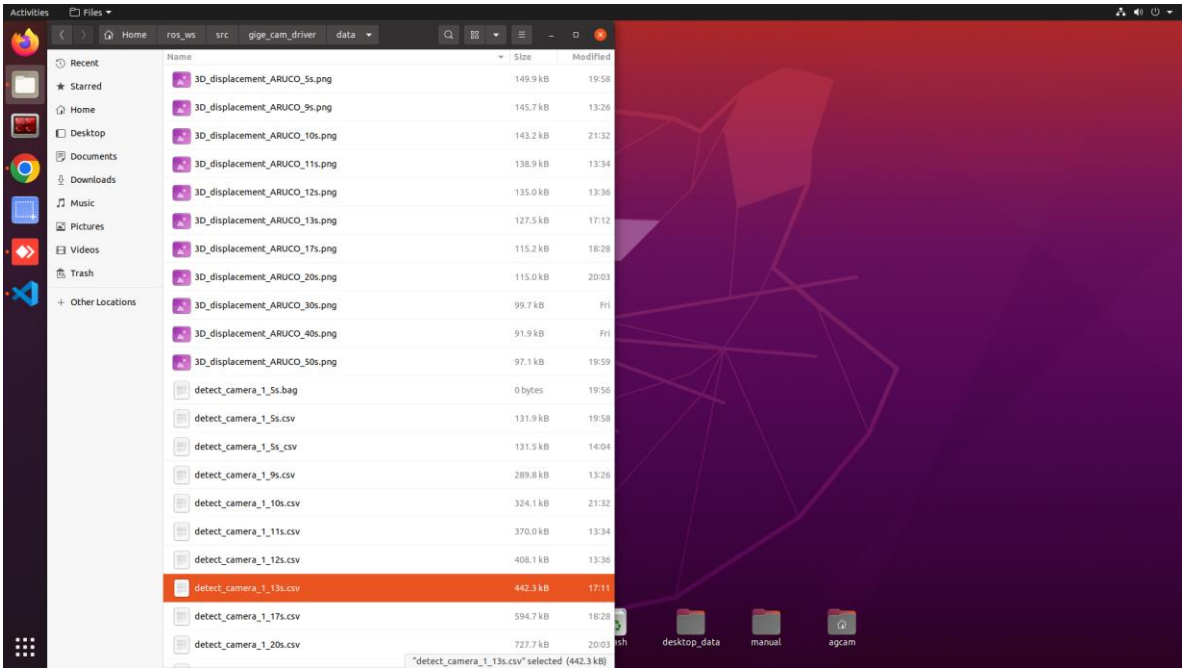


10. To proceed, please close the **Figure** window.

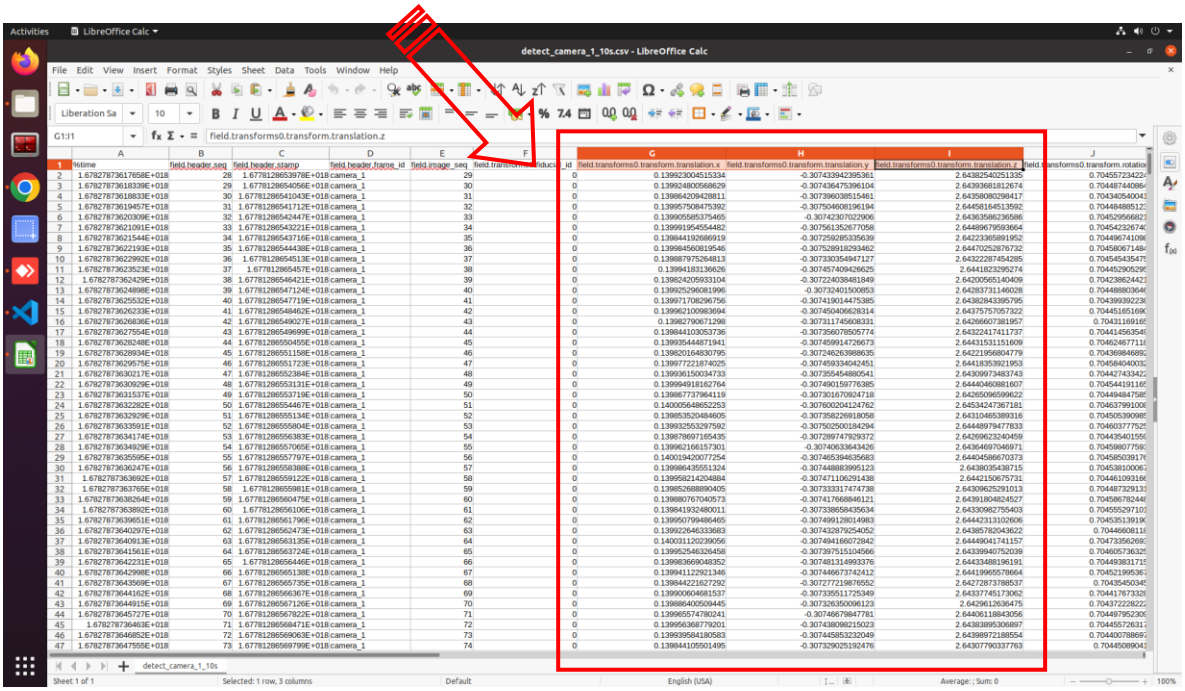
11. The post-processing procedure was completed successfully, displaying the csv file and plot file storage paths as shown in the figure below:



12. The three-**dimensional displacement** data stored as the.**csv files** as well as the **plot images** are stored under the directory **/home/agcam/ros_ws/src/gige_cam_driver/data/**, as shown below**:**



13. The following illustration depicts the contents of a CSV file featuring three-dimensional displacement data:



14. The post-processing **has** completed effectively.