Implementing sample code and tutorials for *Dora-rs*

applicant: Chen Yijun / 陈毅俊

Project ID：259b20001

Abstract: *Pointcloud processing is an important topic in the robotics. Dora-rs as the promising robotic application framework, examples about pointcloud was still limited. This proposal gives my plan about more examples about pointclouds based on current state of Dora-rs*

May 25, 2025

Contents

1. Introduction

Process of *point cloud* is an important topic in the robotics. As more and more flexible robots come to reality. The processes of spatial information are more and more significant.

1.1. Classic Library

- PCL° is a classic c++ library for pointcloud processing.
- ISL organization developed a modern pointcloud library Open3D°.

1.2. Current status

In most cases, ROS uses PCL-related class to process pointcloud data. However, some implementations in PCL are restricted by heavy historic burden. For instance, people tend to write third party libraries to implement their own algorithm like some point cloud registration or some localization jobs. Most of these libraries are just designed for a specific hardware.

With the help of Dora-rs especially the power of Rust, I think it is possible to avoid the risk of some useful data transmutation like the process between Protobuf, PCL PointCloud class, and Eigen matrix which are very commonly used. Another problem is that the messy c++ libraries version control is annoying.

Currently, Dora-rs only supports depth image and ios-lidar which is just depth image as well.

1.3. About Dora-rs

Dora-rs is a modern framework for robotics. Without heavy historic burden, I found it is much easier for developers to focus more on development rather than some complex framework prerequisites. However, native examples on Dora about pointcloud are still missing.

1.4. About myself

I'm Chen Yijun, an undergraduate from Southern University of Science and Technology. Passionate about the open source, I have involved in some interesting projects. To apply the knowledge I learnt from school. I'd like to involve in the development of Dora. Borrowing a sentence from Steve Jobs, I don't want to spend the whole life writing papers that end up like waste paper, and do truly change the world.

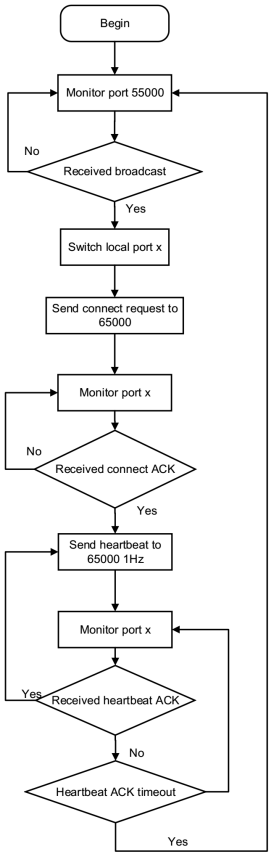
2. Task/Schedule

2.1. Livox Horizon Driver Example

Implement a driver for Livox Horizon lidar° according to the protocol°

Livox series lidar like Horizon and Mid-360 are high cost performance lidar widely used. A Dora-native support could attract more people to experience Dora.

The protocol is based on TCP socket which is mature application in Rust with the help of asynchronous syntactic sugar. The skeleton of the protocol is shown in the figure.



2.2. Fastfomat Interface

Implement the interface for pointcloud convertor in the subproject of Dora-rs Fastformat° like the `image` one.

Nowadays, there are no the most outstanding pointcloud library, so a convertor is still useful to use some library like OpenCV for image. A convertor for Dora native between PCL or Open3D might be required.

2.3. Pointcloud Dataflow Example

Implement an example for the pointcloud data flow like the camera example°

Data flow is one of the main concept of Dora. An example about pointcloud data flow is necessary.

2.4. Rust Native Pointcloud Process Example

Combine Dora-rs with Pasture° which is a rust-native library for working with pointcloud data.

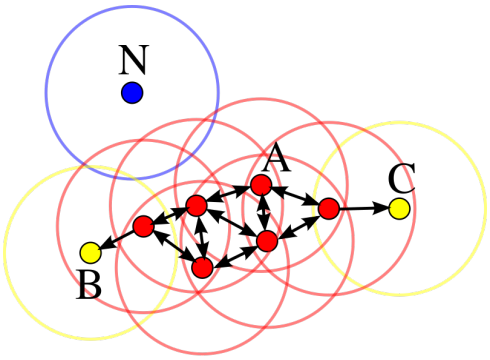
Pasture is one of the rust-native pointcloud library provided some implementations to process pointcloud. Such an example can attract more developers fond of Rust.

2.5. Pointcloud Algorithm Demo

Implement some simple and classic pointcloud algorithm like DBSCAN.

DBSCAN(Density-based spatial clustering of applications with noise) is a classic and simple segmentation algorithm. A simple algorithm is a strong proof of Dora's ability in pointcloud data transmission and processes to attract further development.

The figure from Wikipedia° shows the mechanism of the algorithm.



2.5.1. Pointcloud Semantic Segmentation With Machine Learning(optional)

Sonata° is one of the best model in 3-d segmentation.

A demo combines Sonata with Dora could be very interesting and shows the strength of Dora with advanced model or algorithm.

3. Timeline

According to the coding and development timeline of OSPP. The development date is 07/01~09/30.

3.1. 07/01~07/19(3 weeks)

The lidar driver for Livox Horizon

3.2. 07/20~08/13(3.5 weeks)

Use Rerun to visualize the Pointcloud. I'm not so familiar with Rerun so that I plan to spend more time on it though it might be unnecessary.

3.3. 08/14~08/27(2 weeks)

A convenient convertor in Fastformat

3.4. 08/28~09/04(1 weeks)

A dataflow demo on pointcloud

3.5. 09/05~09/16(1.5 weeks)

A demo combined Dora with Pasture

3.6. 09/17~09/30(2 weeks)

A demo process pointcloud with DBSCAN

3.7. Optional examples about Sonata

Because the my understanding about Rerun in the Section 3.2 is limited now, so I tend to put more time on it. I think there will be extra time if I finish it in advance.

In the extra time, I'd like to use Sonata with Dora another example for Dora.

3.8. 09/30~

Dora-rs, as the promising project on robotics, I think I will continue to contribute to it with my knwoledge and advertise it among my friends.