

RT Systems Lab

**Weekly Report number (1)**



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# This Week's Tasks

* Understanding the camera matrix.
* Writing a CMakeLists.txt file.
* Understanding video files format and how to extract the frames.
* Installing Eigen library for matrix calculations.
* Installing opencv library for C++.
* Implementing video files interface.
* Implementing z-coordinate recovering

# Tasks Done

## Camera Matrix

The camera is a physical device which takes a 3D scene, and converts it into pixels. To be more precise, it takes all points and converts them into points , where all the points are of depth 1. Since this is not a bijection, we need more than one picture to recover the z-coordinate. The camera matrix is a matrix that recovers the points with normalized z coordinate . Let let the camera matrix, then:

Where is the center of the image in pixels and are the focal length of the image.

With simple calculations one can see that:

If is the depth of the point, then

Now let's look at two frames with vertical translation upwards as described in the following figure.

Figure 1: read frame is frame k-1, and black frame is frame k. we look at the y coordinate of the same point in two different frames, and calculate the depth using the distance

We can see that

And therefore, we can conclude that:

And hence,

Therefore, we can conclude that: