Lab Report-3
MOVING OBJECT IMAGING

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Goal

To study an imaging solution with the help of Line Scan Camera for analysing moving objects and to examine and understand specific features of the imaging system.

Apparatus Used

- PC Computer
- Frame Grabber: DALSA XCELERA-CL LX1
- Digital Line CCD Camera: DALSA S2-1X-02K40
- 50mm Lens: PENTAXYF5028A-02
- Video Cables
- 12V Power Supply
- Moving Industrial Parts
- Signal Generator
- Oscilloscope

Software

CamExpert – TELEDYNE DALSA

Procedure

Moving Object Imaging without External Trigger

The experimental setup was completed with connecting the Camera with the PC Computer and the Camera focus and aperture were adjusted. The objects were made to rotate and we grabbed images as shown in figure 1.

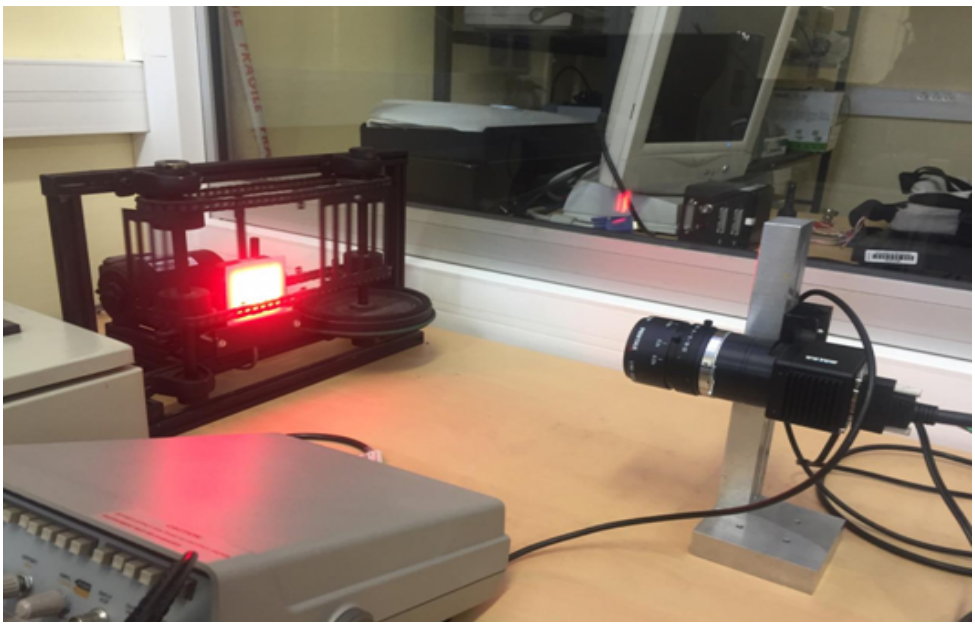


Figure 1: showing the Experimental Setup

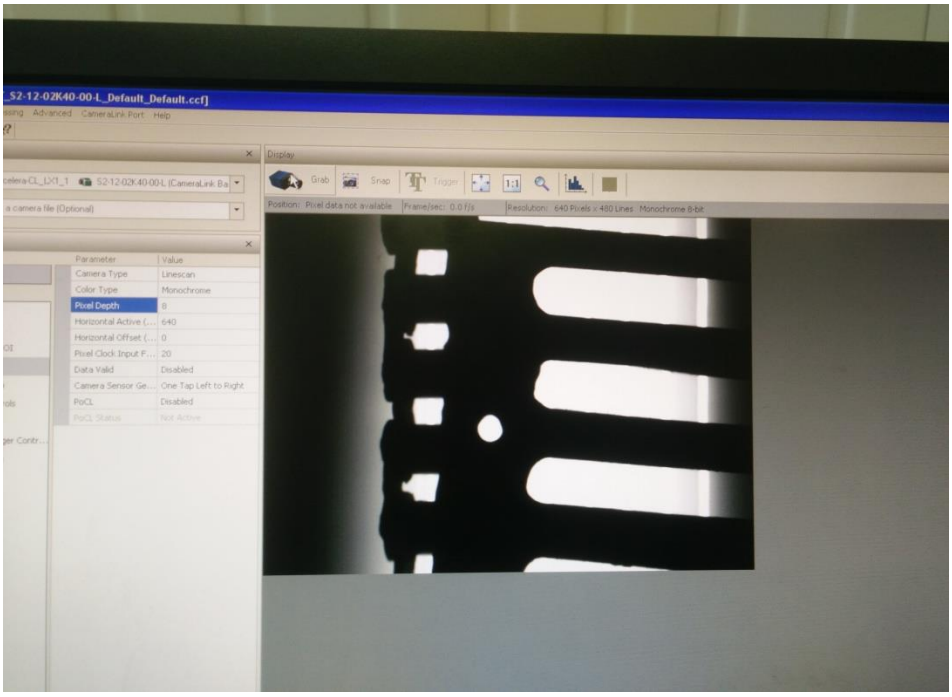


Figure 2: Image acquired after setup.

Relationship between the Parameters

We observed that the number of lines in the image (say height of the image) can be changed by adjusting settings in the software. The parameters like acquisition rate, area of scanned image can be altered. The number of lines is inversely proportional to the frame rate. This concept is used for gaining a constant acquisition rate. For area, the frame height is proportional to area of object scanned. The exposure time is also inversely proportional to the line rate, therefore higher the line rates darker is the image as shown in figure 4.

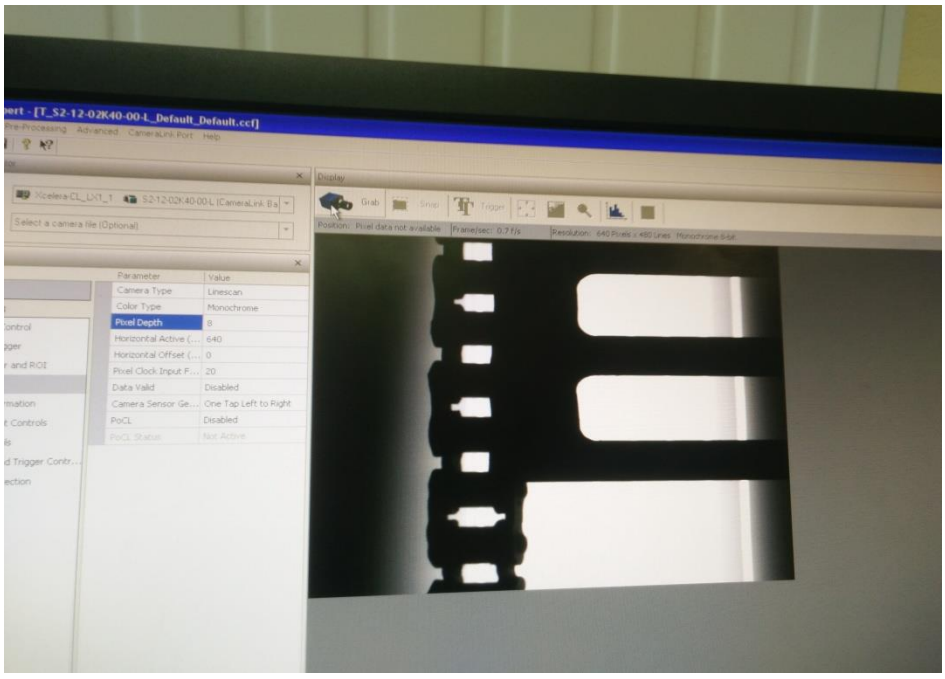


Figure 3: Bright Image with Low line rate

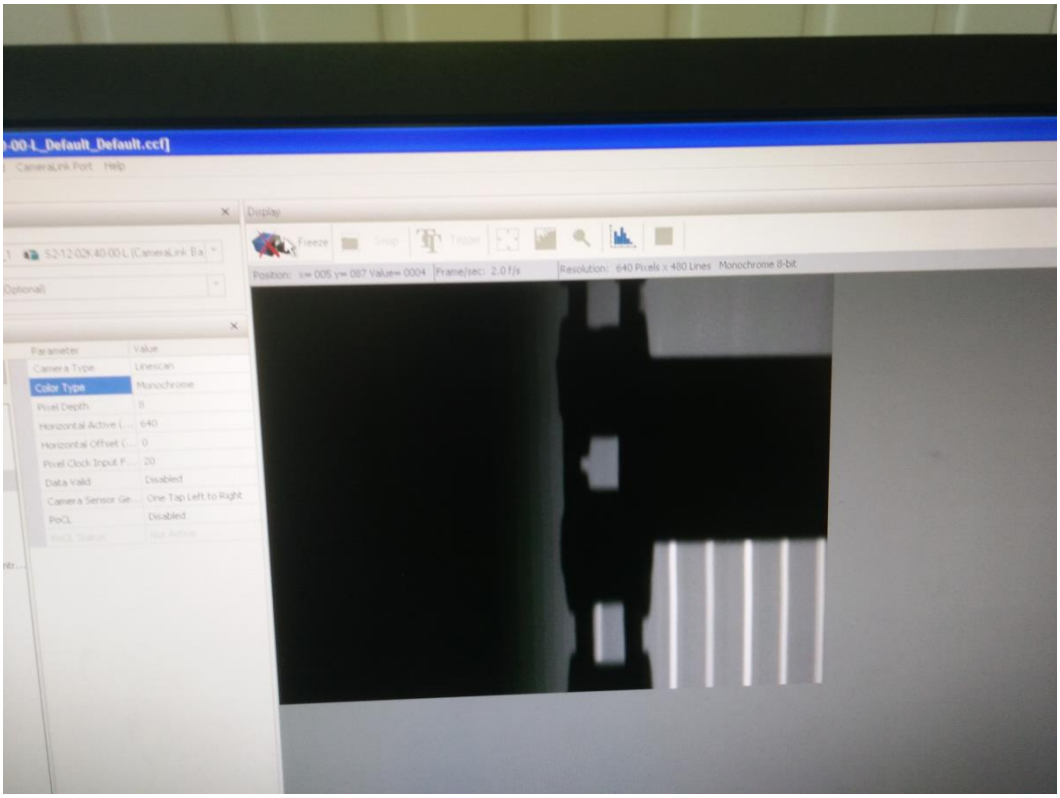


Figure 4: Image with increased line rate

Moving Object Imaging with External Trigger

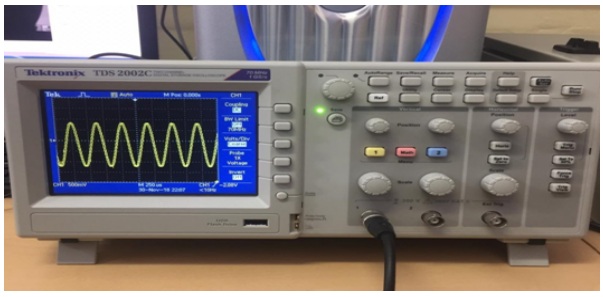
We can alter the acquisition rate using the external trigger. We enable the external trigger option in the software for external signal to work. So for this we need to setup the signal generator which generates a square wave of certain frequency.

Setting up signal generator and observations

To set the generator, we need to know the maximum frequency we can send to the acquisition board given a certain Line Rate (Line/sec) and a certain Height (Line). So for instance, to get 10000 lines/sec at a height of 500 lines, we need a maximum frequency of:

$$f_{max} = \frac{10000}{500} = 20Hz$$

This is the maximum frequency we can set to grab data at specified constraints. We set the generator to 5Hz to be sure it does not overpass the maximum frequency. The result is as shown in figure 5.



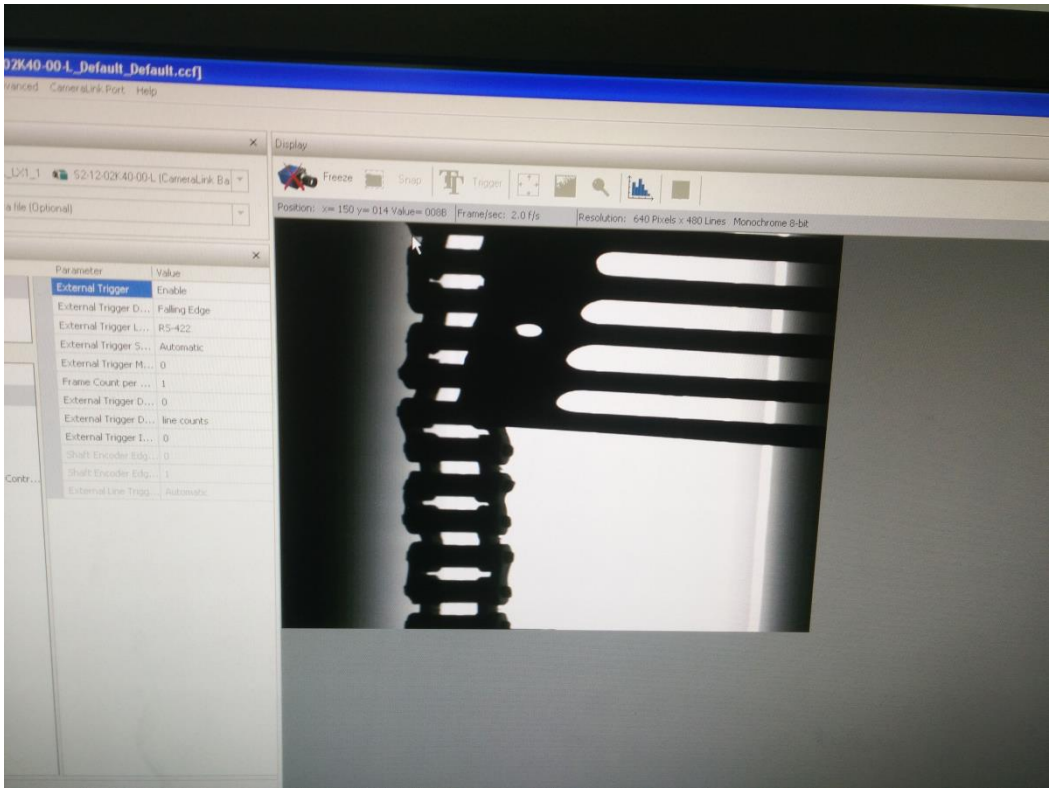


Figure 5: Image taken for 10000 lines/sec 500 lines at 20Hz max frequency

Conclusion

Line sensors have very good performance and are cost effective. But they are mainly application oriented. Calibration and adjusting parameters of camera is very much significant to get good quality images. At a constant resolution, if we decrease the lines (image height) the density is increased so we get an enhanced image.