# Prototyping a composite view for park assist cameras in automotive vehicles

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Background and purpose

The purpose of this thesis is to investigate the possibility of presenting a composite view for the driver, meaning both the Bird's-Eye View (BEV) and rear view being rendered on the car's infotainment display simultaneously. This was achieved by developing two prototypes, based on current hardware and next generation hardware respectively.

The idea behind presenting both views simultaneously is their contrasting usefulness in different situations. The BEV provides an overview of close proximity surroundings in every direction, whereas the rear view provides more depth in the image though only in the backwards direction. Thus, showing both views together may be desirable for the driver.
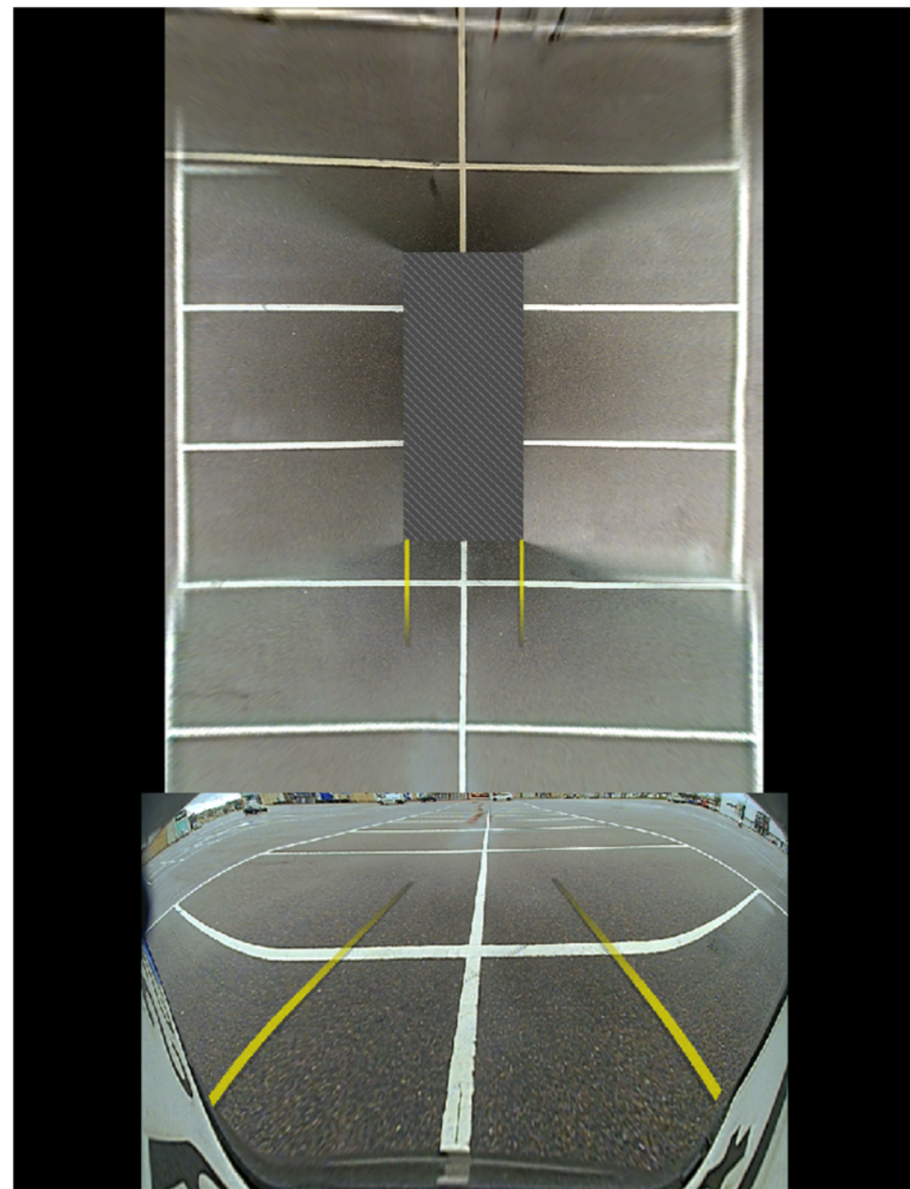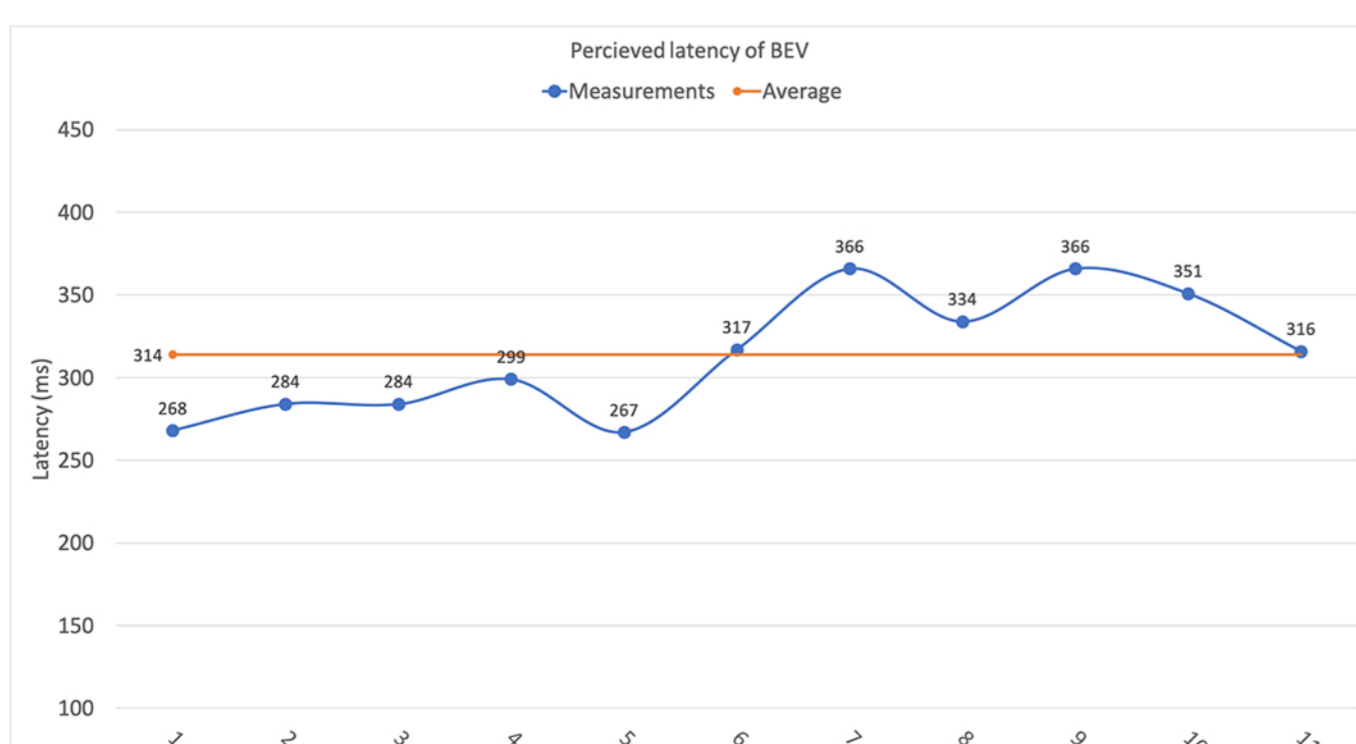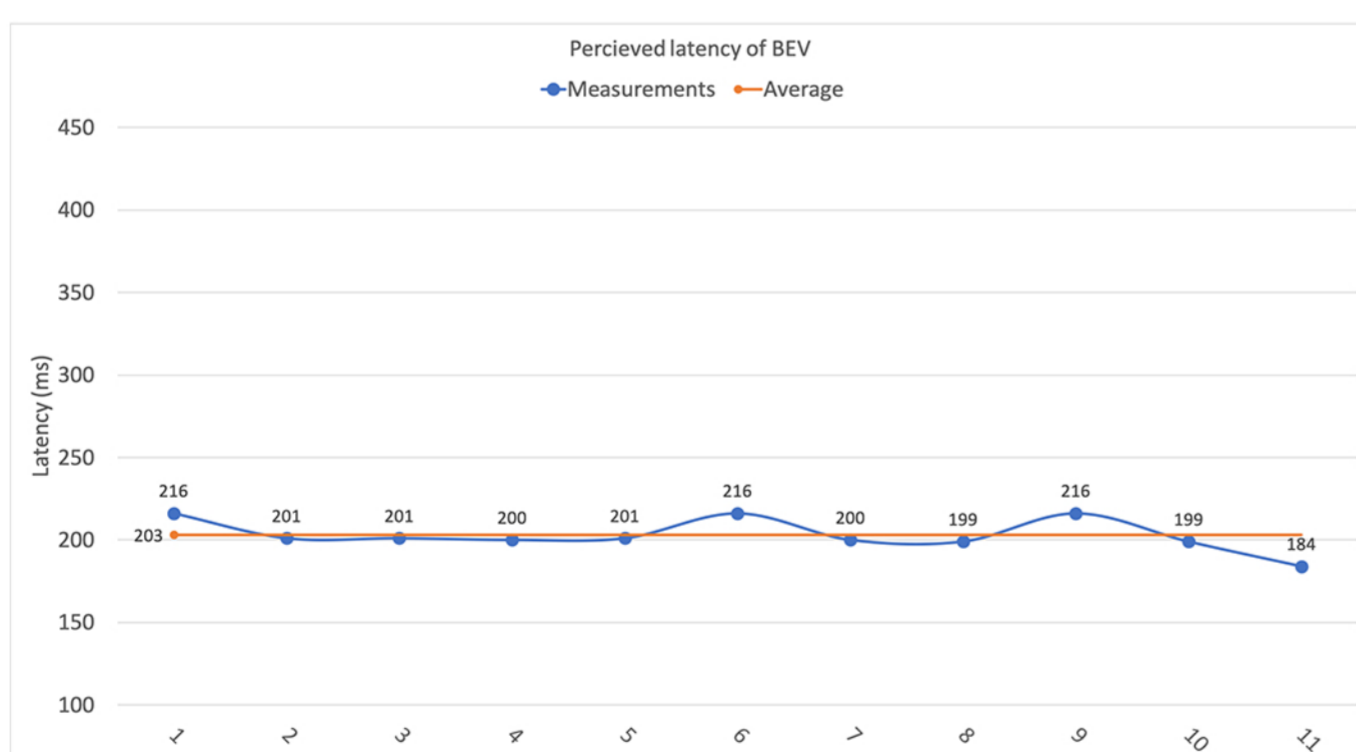

To achieve the goal of this thesis, the following questions are meant to be answered:

1. How is the first prototype limited by the CCM?
2. What deficiencies are present in the prototype based on current generation hardware?
3. How does the performance compare between current generation hardware and next generation hardware?
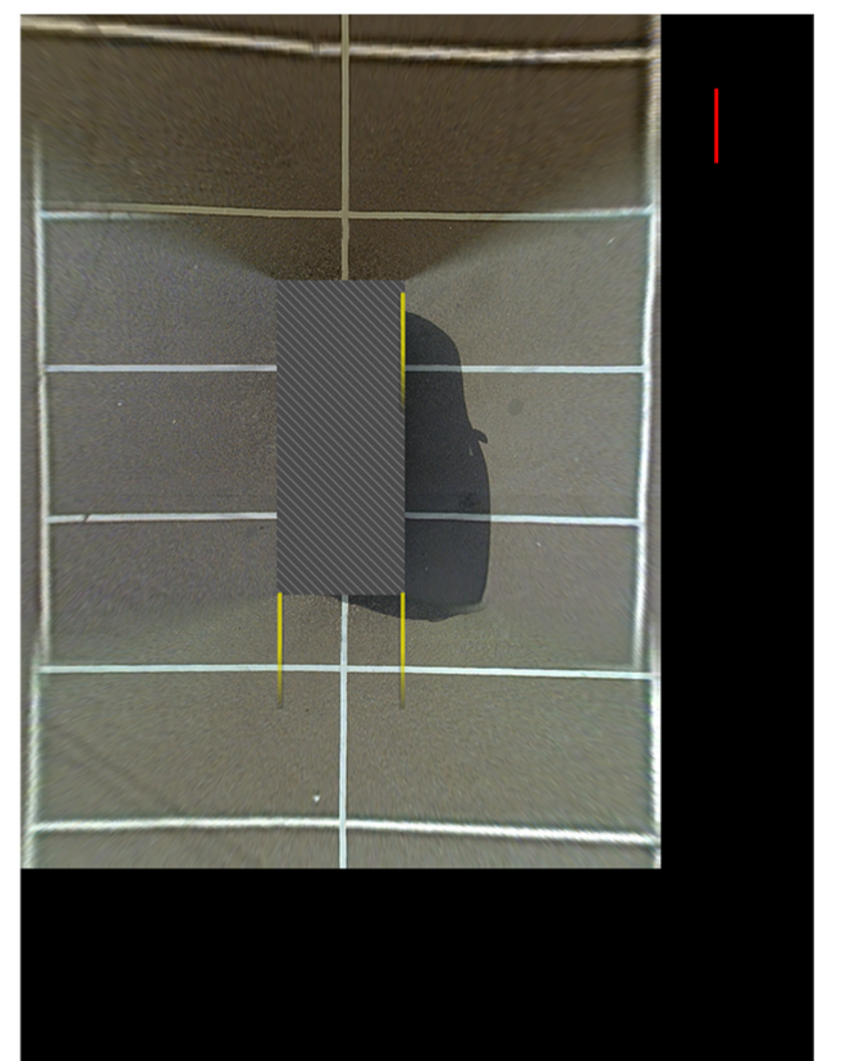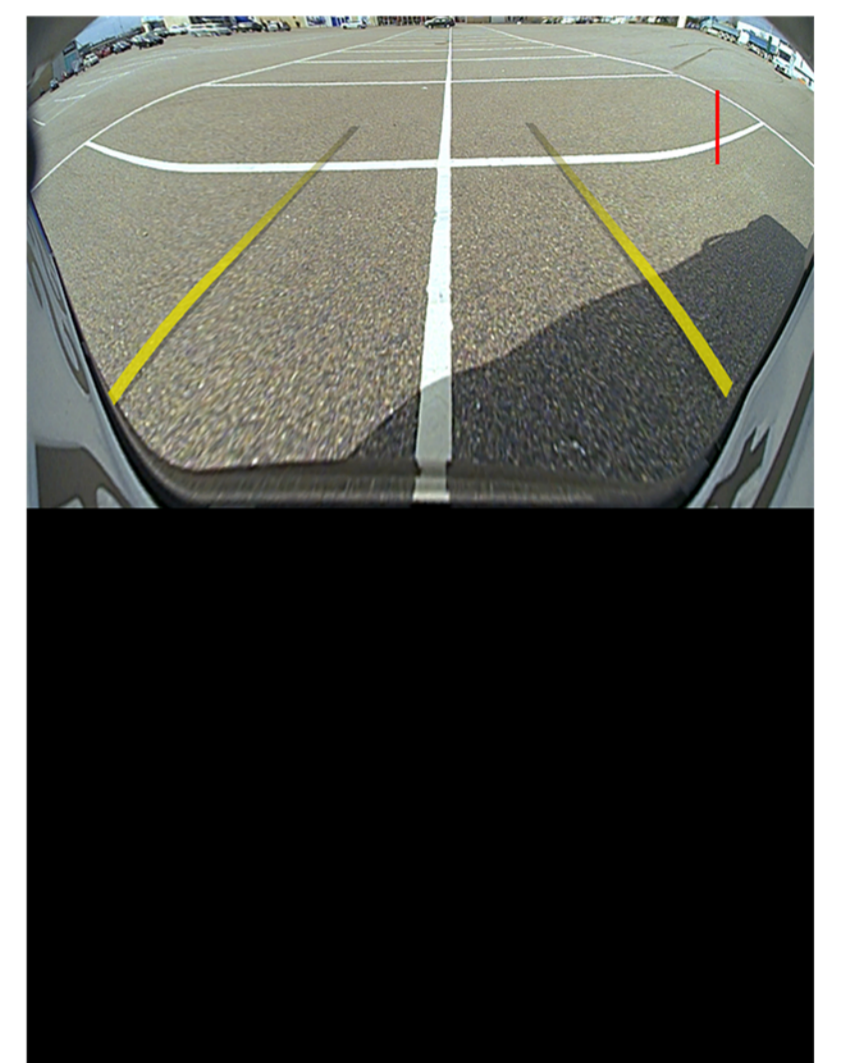
Method

The first prototype initially consisted of VCC's current PAC application, only capable of viewing either the BEV or the rear view. To achieve the final prototype, the functionality was extended incrementally to keep the prototype in a working manner at all times. The first step was to create two render surfaces to render the camera stream in. Then these two stream was alternated in the highest possible frequency . Finally, each surface was altered to selectively render only the correct frames.

The final step was more challenging than initially imagined, since it required knowledge of what view is currently streaming. After approaching the problems in three different ways, the most successful approach was to analyze each incoming frame to identify it based on the different aspect ratios of the views. By analyzing the pixels, marked by a red line in the two figures, it can be concluded to either be a frame of the BEV or rear view, depending of if all the analyzed pixels are black.

Development of the second prototype was more straight-forward since most of the functionality was already in place. Most of the required development was creating the layout and undistortion of the camera frames.

Result

The result of the first prototype is shown in the figure to the right. It and managed to output 13 and 17 fps in the BEV and rear view respectively.

The perceived latency is presented in the two graphs, where the top graph is the perceived latency when not showing the composite view and the bottom graph is when showing the composite view.

Conclusion

1. How the first prototype is limited by the CCM

The CCM's different output modes can't be altered by third parties . Thus a single output frame can't contain both the BEV and the rear view. This limitation requires partitioning of the output stream by alternately switching between either the BEV or rear view. Therefore, the BEV and rear view cannot both achieve a frame rate of 30 fps.

2. Deficiencies in the first prototype

The prototype introduces two deficiencies to the system. Firstly, the frame rate experience a performance reduction of 43% for the BEV and 56% for the rear view when comparing with the single view with update frequency of 30 fps. Secondly the perceived latency is increased, partly as a result of the reduced frame rate.

3. How the performance compares between the first and second prototype

The first prototype provides a higher frame rate than the second prototype. However the perceived latency is similar in both prototypes.