

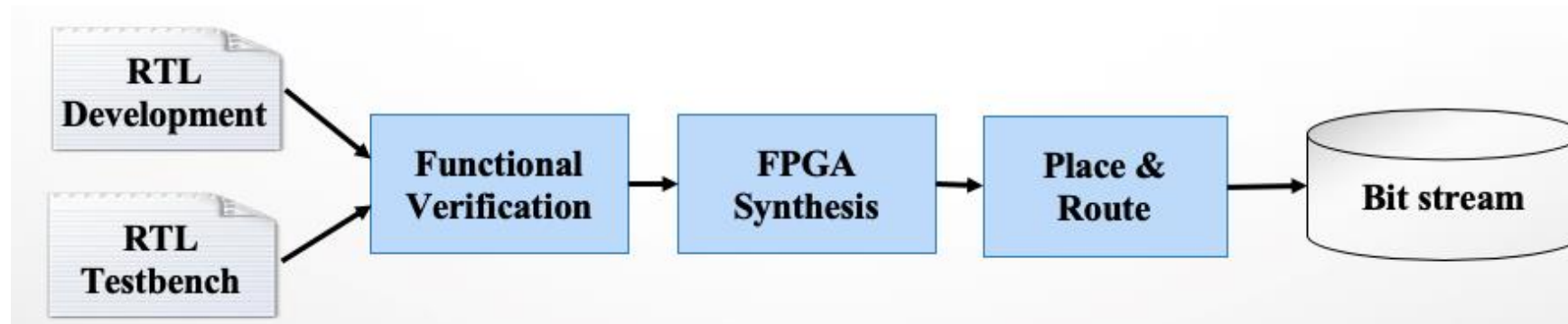
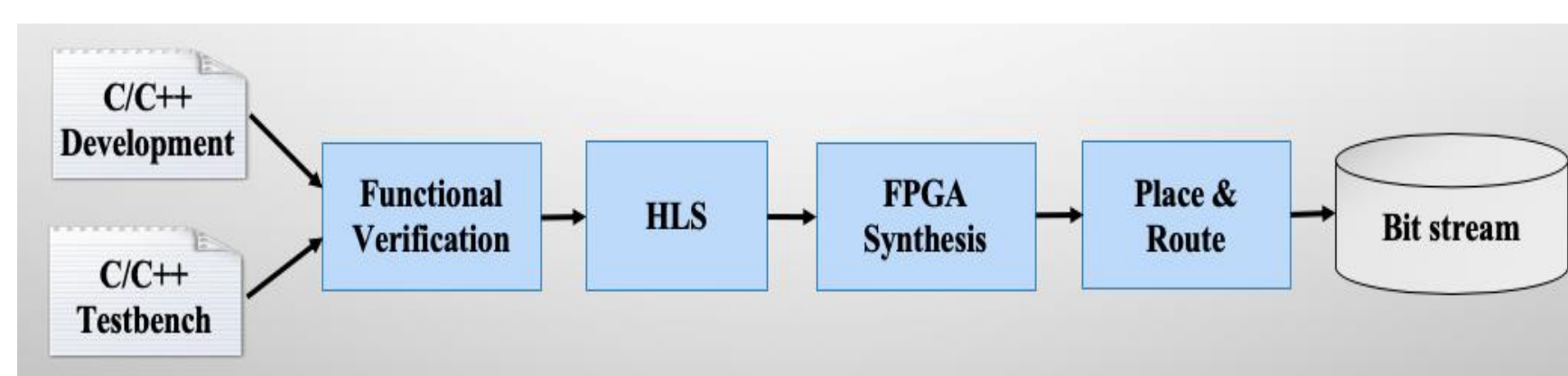
## ABSTRACT

- ❑ Map a robust multi-object tracking algorithm onto an FPGA
- ❑ Implement coded exposure alongside object tracking on the FPGA board
- ❑ The programmed FPGA will drive an image sensor
- ❑ Will be designed for space applications

## PROJECT AIM

- ❑ Energy efficient object tracking and motion deblurring
- ❑ Enhance self-protection capabilities of the space navigation system
- ❑ Capture high quality space images

## TWO POSSIBLE DESIGN FLOWS



## PROPOSED ALGORITHM

- ❑ Our algorithm will be developed on top of an existing codebase [1]
- ❑ Tiny-YOLO (a CNN) and a constant velocity Kalman filter used for multi-object tracking from frame to frame

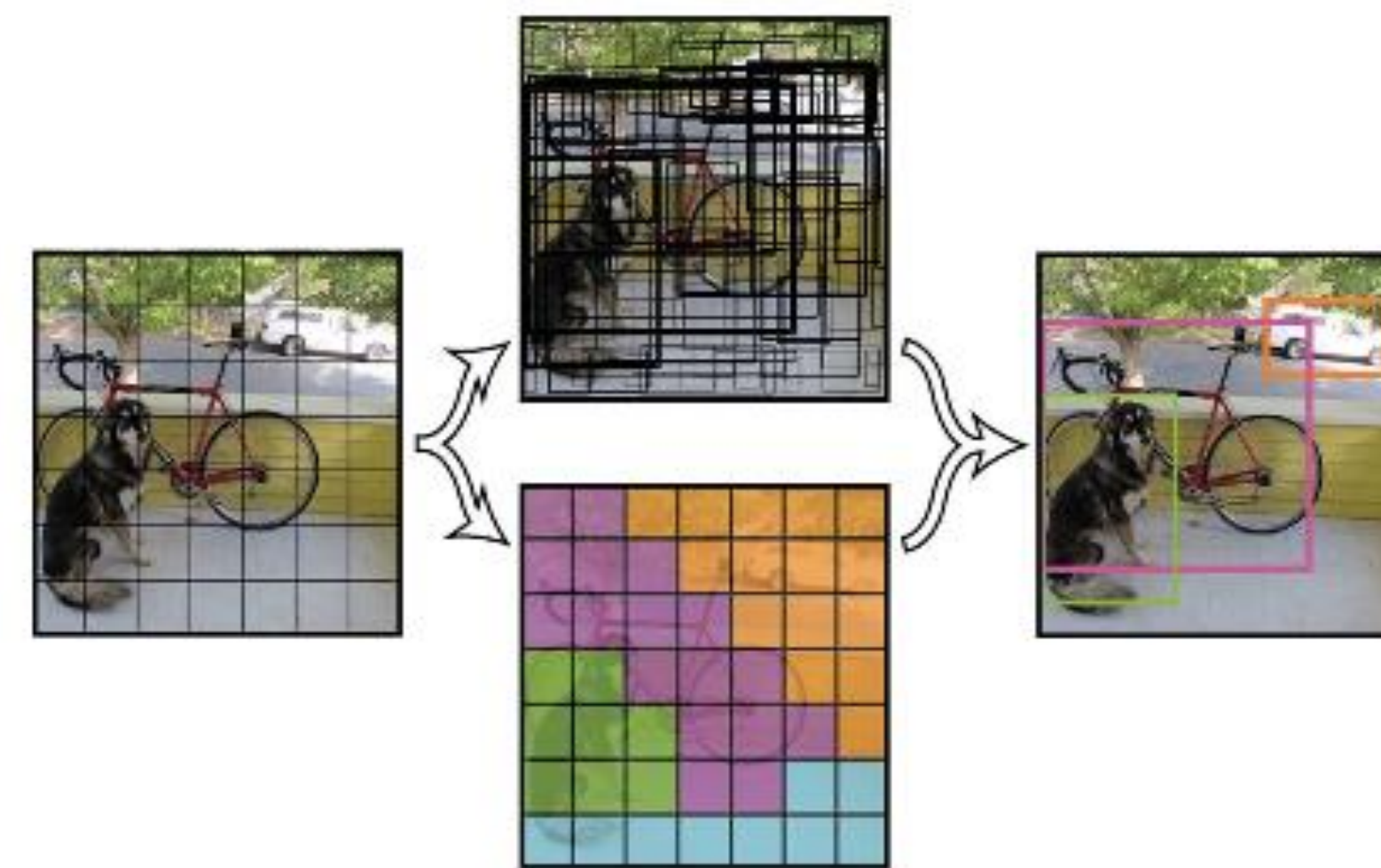


Figure – Tiny-YOLO Visualized [3]

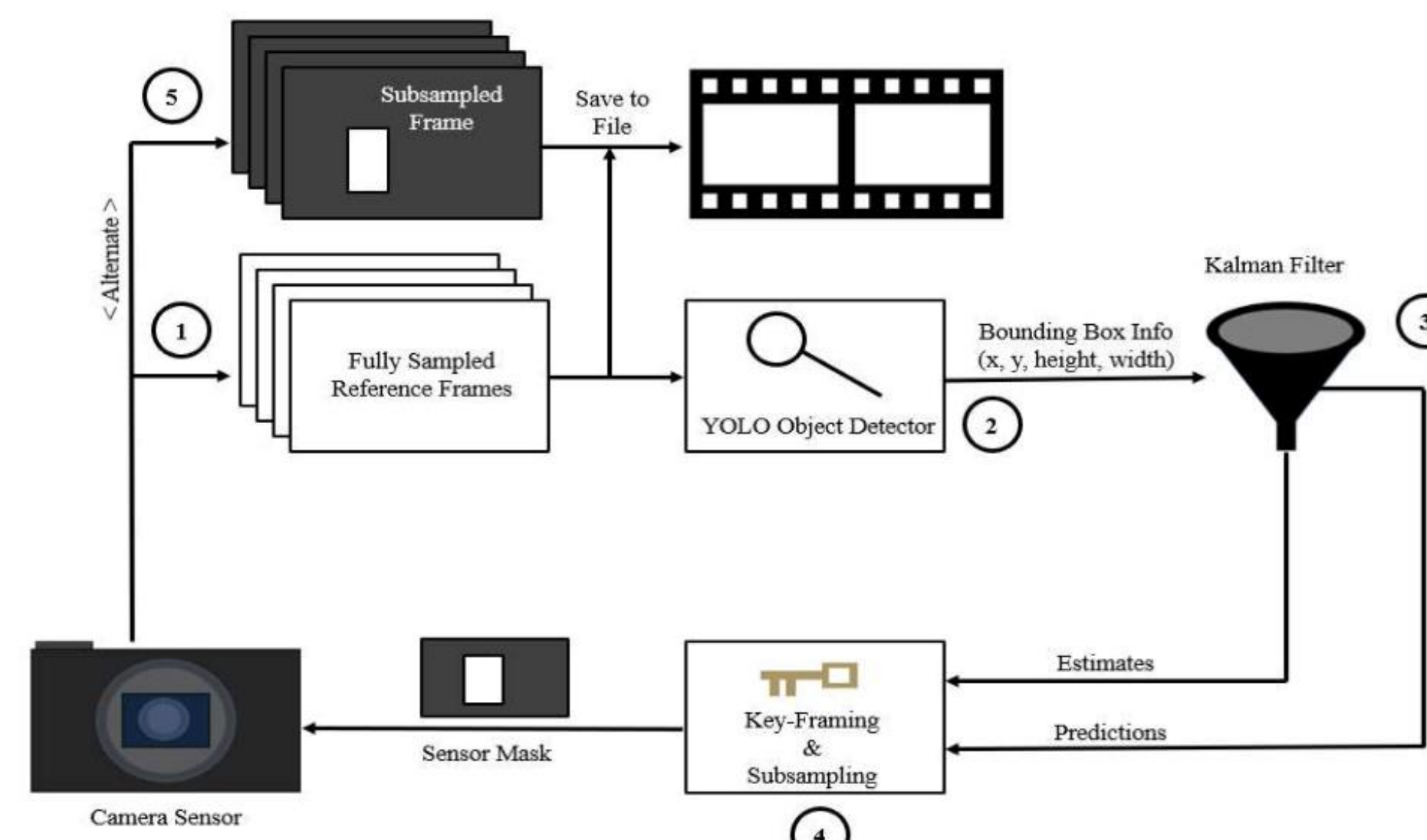


Figure – Proposed Algorithm for Single Object Tracking[1]

## MOTION DEBLURRING

- ❑ A later goal for this project is to implement coded exposure (fluttered shutter) on an FPGA

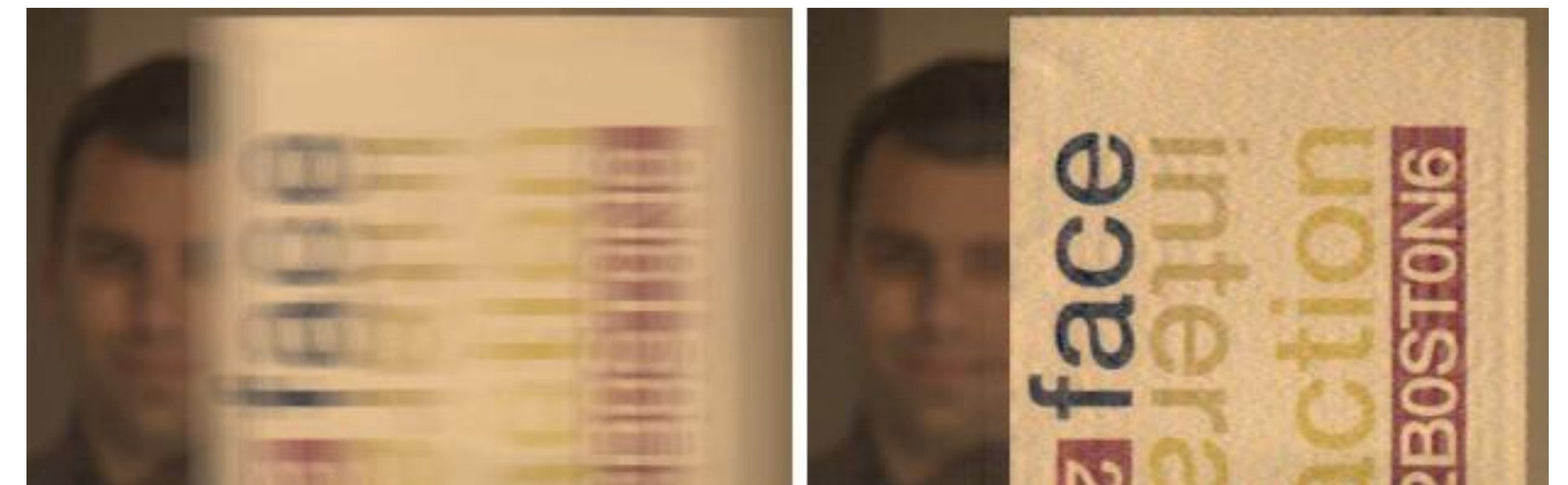


Figure – Motion Deblurring Via Flutter Shutter [2]

## CURRENT & FUTURE WORK

- ❑ Extend the single object tracking algorithm for multi-object tracking
- ❑ Improve energy efficiency via adaptive frame rate
- ❑ Have the Kalman filter state space matrix adapt the frame rate
- ❑ Map the flutter shutter code onto FPGA
- ❑ Look for a good trade-off between energy efficiency and tracking accuracy

## REFERENCES

- [1] J. Martin, S. Katoch, S. Jayasuriya, and A. Spanias, "Kalman filter driven video subsampling for energy efficient computer vision," *under preparation*
- [2] R. Raskar, A. Agrawal, and J. Tumblin, "Coded exposure photography: motion deblurring using fluttered shutter," *ACM Transactions on Graphics (TOG)*, pp. 795-804, vol. 25, issue no. 3, Jul. 30 2006
- [3] Redmon, Joseph, Santosh Divvala, Ross Girshick, and Ali Farhadi. "You only look once: Unified, real-time object detection." In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, pp. 779-788. 2016

## ACKNOWLEDGEMENTS

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