# FIXATION SENSATION!
Real-Time Video Stabilization

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MOTIVATION

Stabilizing shaky video is desirable in many applications but it does not come standard in many devices. This feature is available only in high value products such as the iPhone 4S, DSLR camera lens, etc. The objective is to prove that this concept can be easily implemented and be applied to other devices.

Users that find purpose for this application are ones who focus on using any type of camera for their work. This device could be used on police scanning machines, professional videographers, and surveillance cameras.
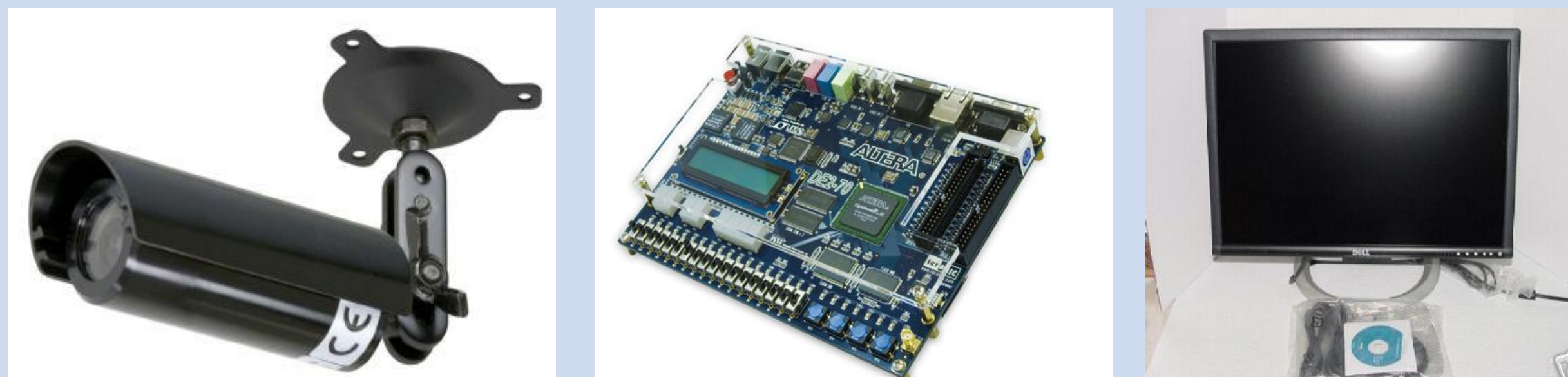
SYSTEM ARCHITECTURE
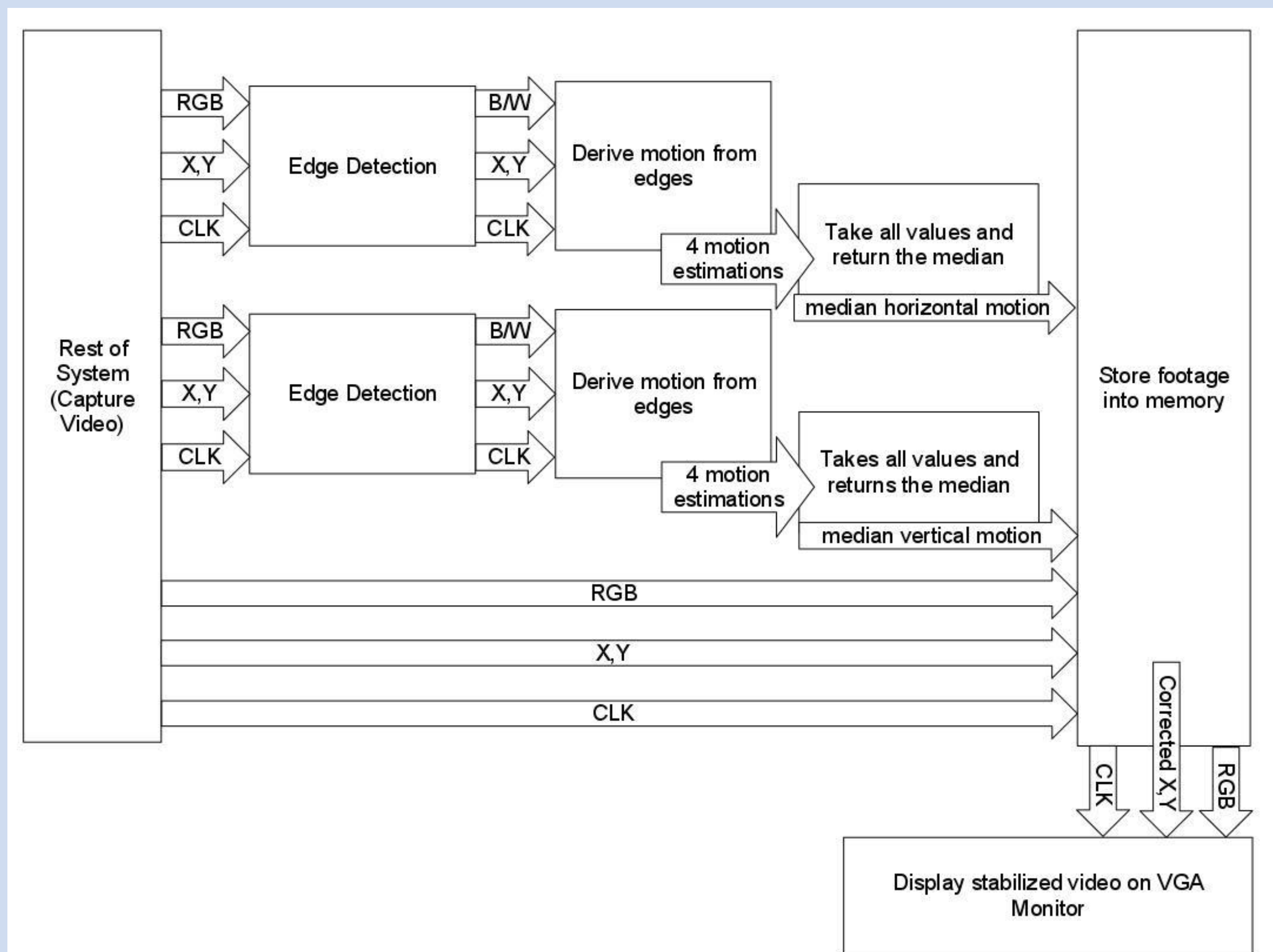
ACKNOWLEDGEMENTS

- TI
- Altera
- Professor Brehob
- Professor Emeritus Dr. Metzger

HARDWARE

- Bullet Telpix Bu 1004DN camera
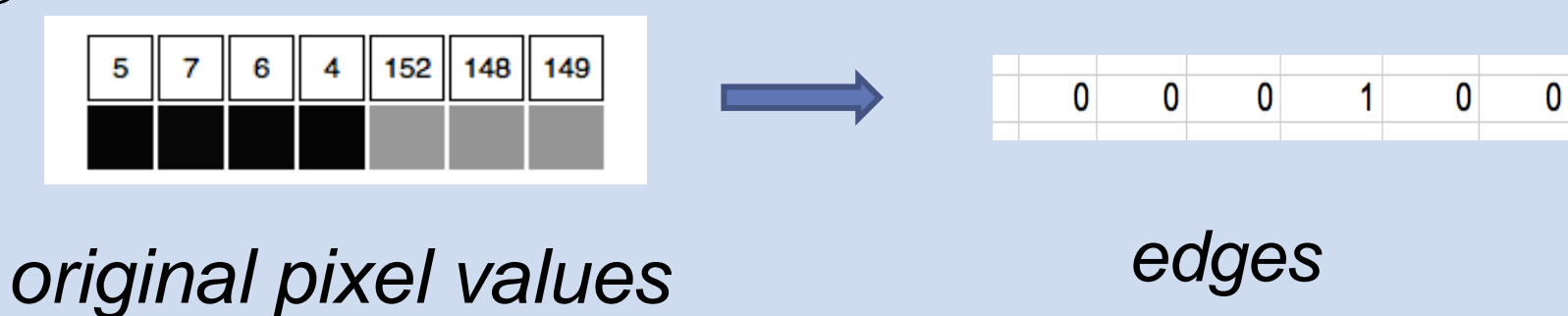- Altera DE2-70 FPGA board
- VGA monitor for display

IMPLEMENTATION

Motion detection

Edge Detection: Find abrupt changes in consecutive pixel color values
Assign edges in frame based on thresholding these changes
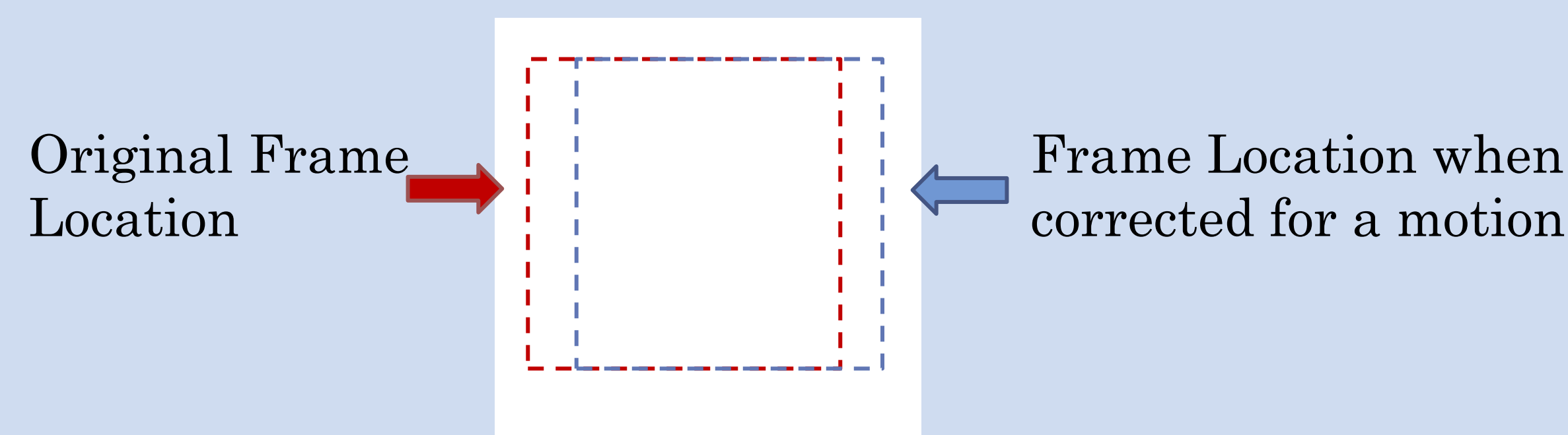

original pixel values   *edges*

Frame comparison: Move current frame in search range and compare to previous frame
Movement with the most matches of edges decides the motion needed to correct

Previous video frame   *Current video frame*
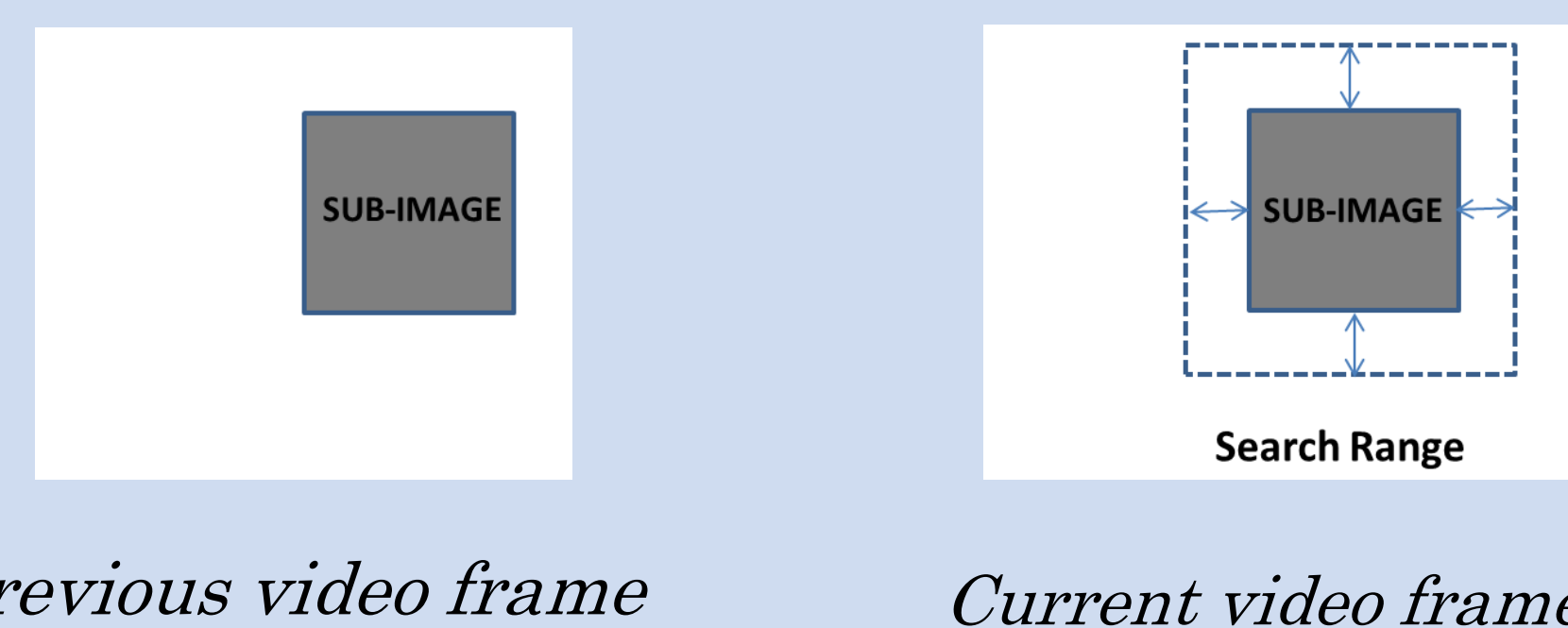
Motion correction

Frame Shift: Shift frame to the location chosen by frame comparison

Original Frame Location   Frame Location when corrected for a motion

DESIGN RATIONALE

Why Edge Detection?
Changing the threshold changes the number of edges used in motion detection. Increasing the number of edges leads to more accurate motion detection, but also increases the noise. Therefore, there is a tradeoff between the number of edges and amount of noise.

How Do We Compare Frames?
Perform an XOR operation using the 1s and 0s of the edge detected images and count the number of 1s. The 1s represent mismatches, and the comparison with the least 1s tells us the motion.

FUTURE WORK

There are a number of ways we could improve our video stabilization system

There are 3 main camera movements:
- Translational
- Rotational
- Scaling

We have successfully stabilized translational motion. With future work, we can stabilize rotational and scaling motion

There are 4 situations:
- Still scenes
- Object movement in frame
- Zooming
- Panning

We have successfully stabilized still scenes. With future work, we can allow object movement in frame, zooming and panning