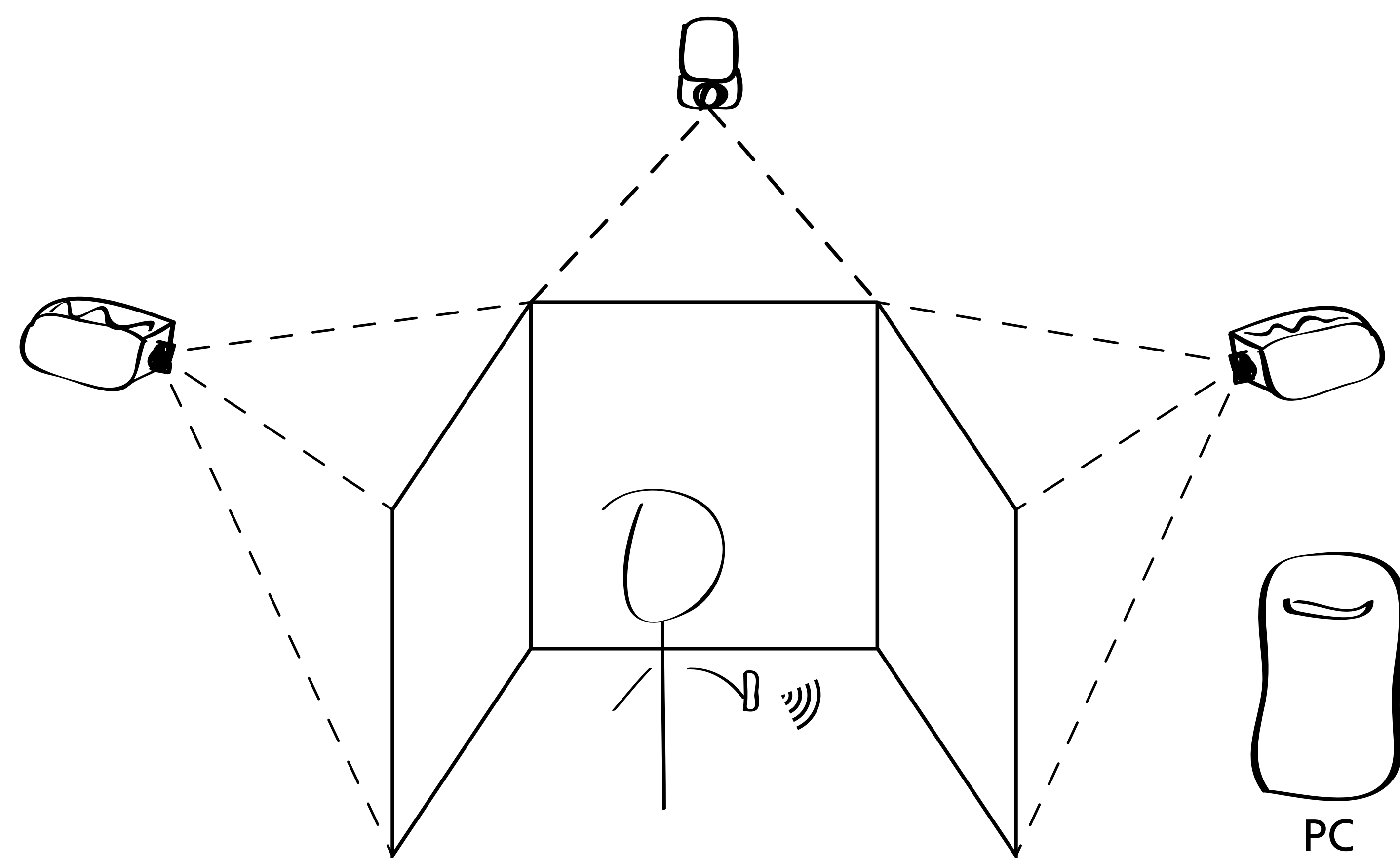


Data Traffic Reduction in Vision Applications using On-Board FPGA-based Image Preprocessing

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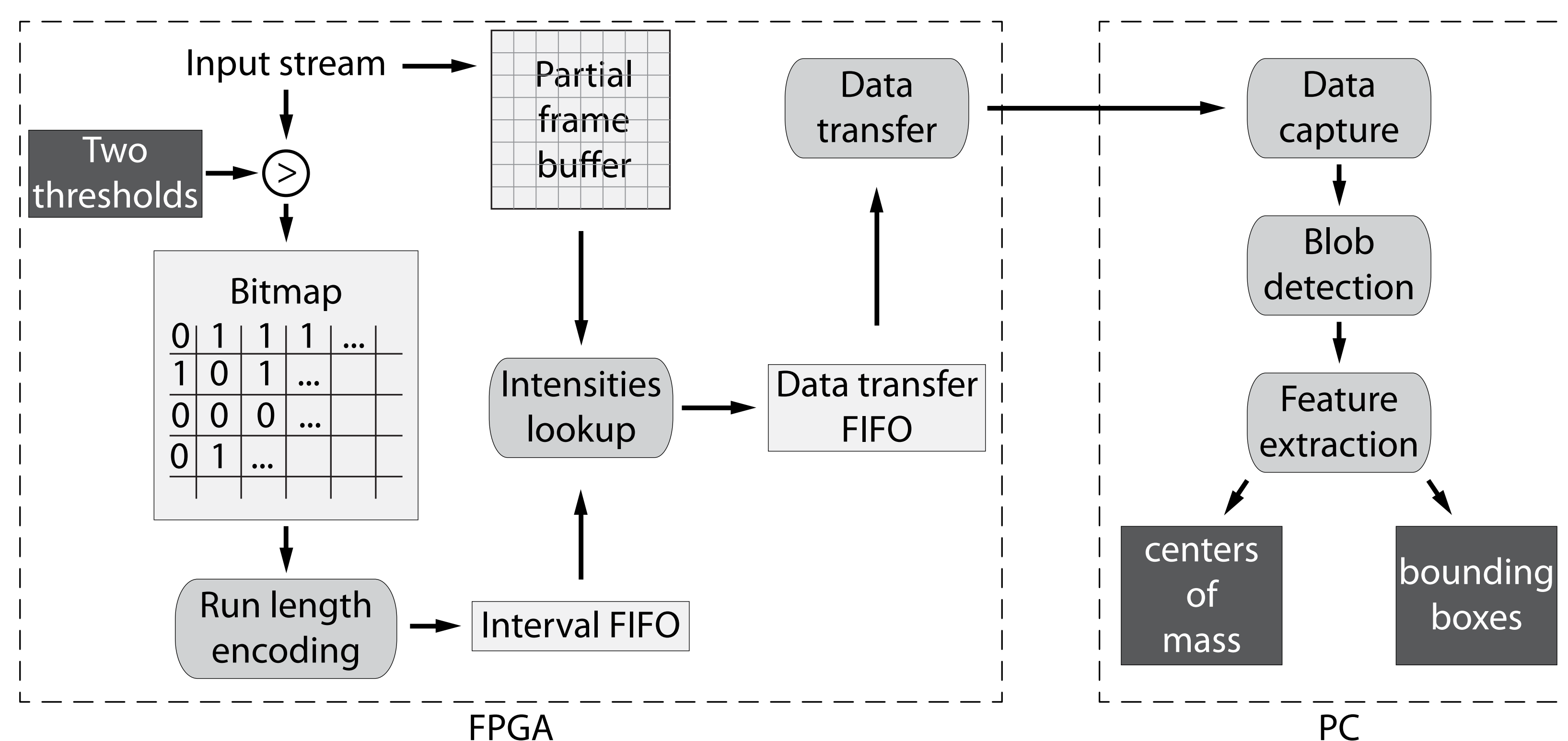
Objectives

The purpose of this project is to develop an approach for detecting centers of light spots on a mobile device equipped with a camera. The system has to deal with low bandwidth requirements, but at the same time, must react quickly to user input and deliver the coordinates of the light spot centers with high accuracy.



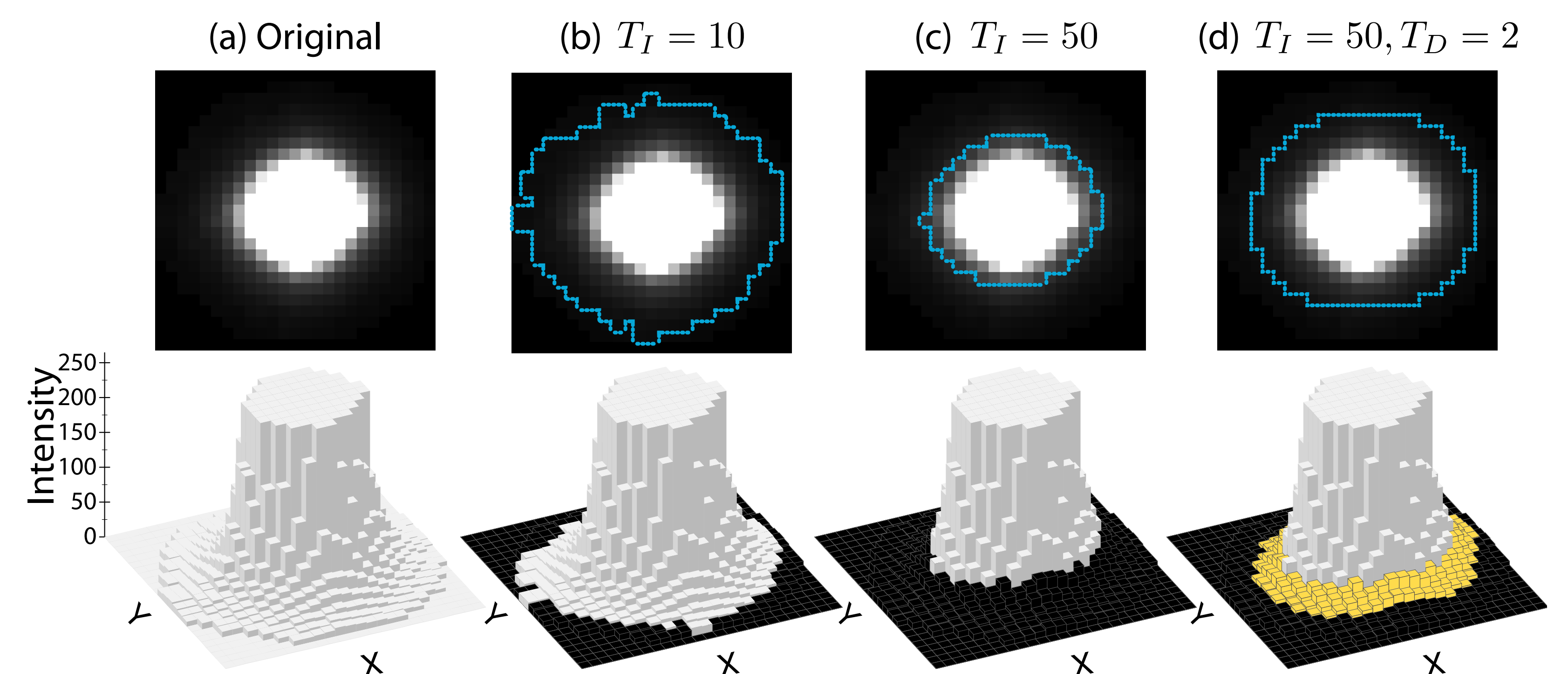
Motivation

The Immersion Square is a visualization system for virtual environments. The user is surrounded by three projection screens and can interact with the system by using a mobile 6 degrees of freedom device. Three projectors cast a set of infrared light spots arranged in a specific pattern onto the screens from the back. The device is comprised of a camera and an FPGA, and is connected to a PC over a wireless interface.



Methods

The task of blob detection is accomplished by splitting it between an FPGA and a PC. The FPGA preprocesses the images by extracting regions of interest and sending the intensity values of each region to the computer over a wireless interface. The PC extracts the data and computes the centers of the light spots, which can be used for estimation of camera position and orientation.



Intensity and distance thresholding for identification of foreground pixels. (a) Original image. (b) Intensity threshold of 10. (c) Intensity threshold of 50. (d) Intensity threshold of 50 and distance threshold of 2.

Results

Evaluation results show that for a camera running at 100 frames per second with an image resolution of 640x480 and a bandwidth limited to 100 Mbit/s, the FPGA is able to transmit a sufficiently large number of blobs for camera pose calculations.

