Calibrating the Kinect with a 3D projector to create a Tangible Tabletop Interface

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Abstract

In this poster we present a portable and easy to calibrate 3D tabletop display enabling easy understanding of complex datasets and simulations by providing a visualization environment with natural interaction. This table enables users to interact with complex datasets in a natural way and engenders group and collaborative interaction. We also demonstrate the use of the display with an example environmental visualization tool, designed specifically for stake holder engagement.

Introduction

In previous work, we presented a 3D tabletop display [1], which used a 3D projector to turn a desk into a 3D immersive display. A Kinect game controller provided basic interaction within the environment. However this set-up relied upon the accurate alignment between both the projector and Kinect, and both being directly overhead. We have extended our software to allow the Kinect to be calibrated to the tabletop from any arbitrary position.

[1] L. ap Cenydd, C.J. Hughes, R. Walker and J.C. Roberts, "Using a Kinect Interface to Develop an Interactive 3D Tabletop Display", EG 2011 - Posters, R. Laramee and I. S. Lim (Eds.), pp 41-42, Llandudno, UK, Eurographics Association, 2011.

Method

Figure 1: View from the Kinect's perspective

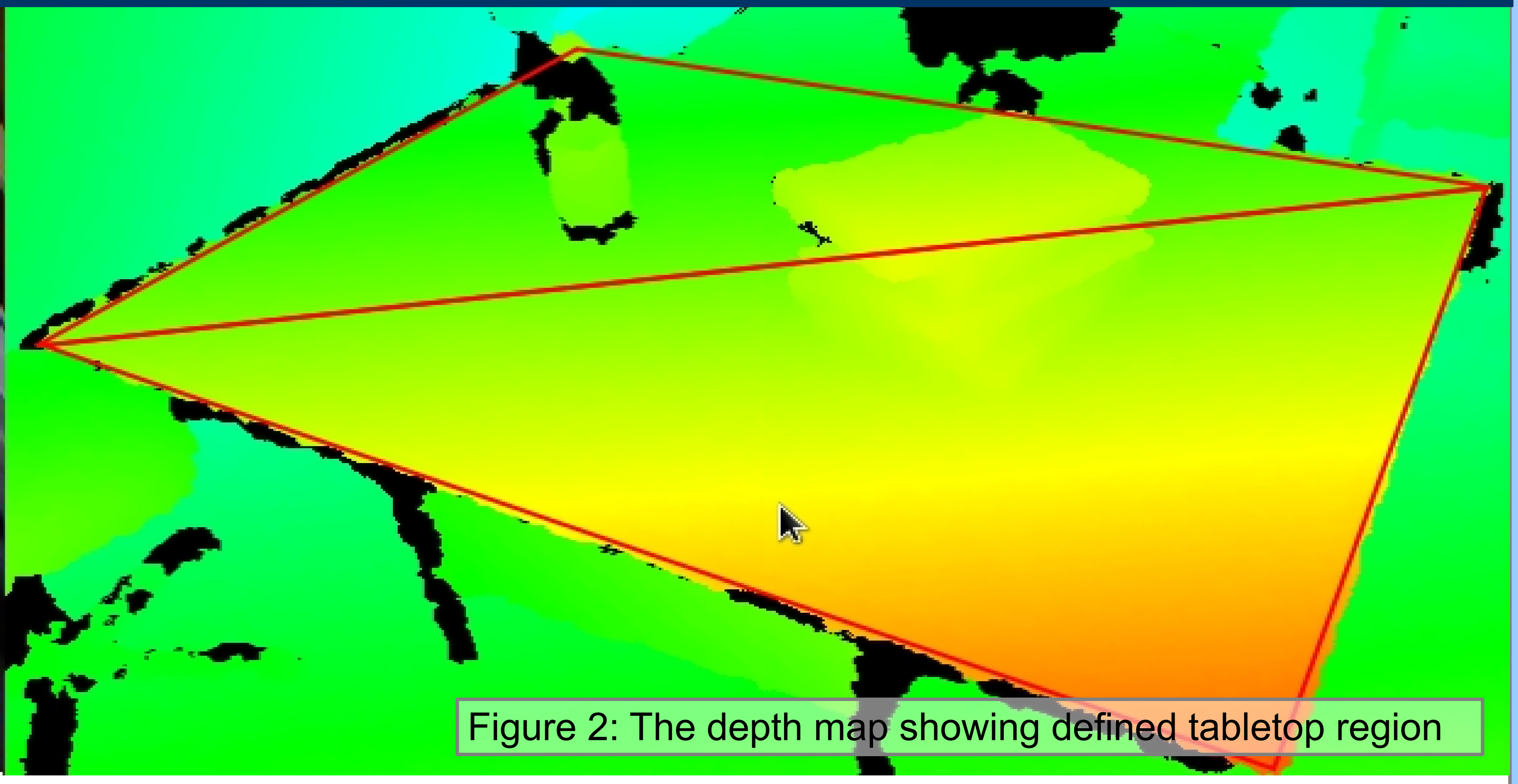

Figure 2: The depth map showing defined tabletop region

OpenKinect (openkinect.org) was used to capture the viewpoint (figure 1) and depth map from the Kinect (figure 2). In order to calibrate the view the user initially selects the four corners of the tabletop display from within the Depth View. As it is assumed that the 3D position of the corners are coplanar, the defined surface is split into two triangles and an average gradient calculated for the surface, as shown in figure 2.

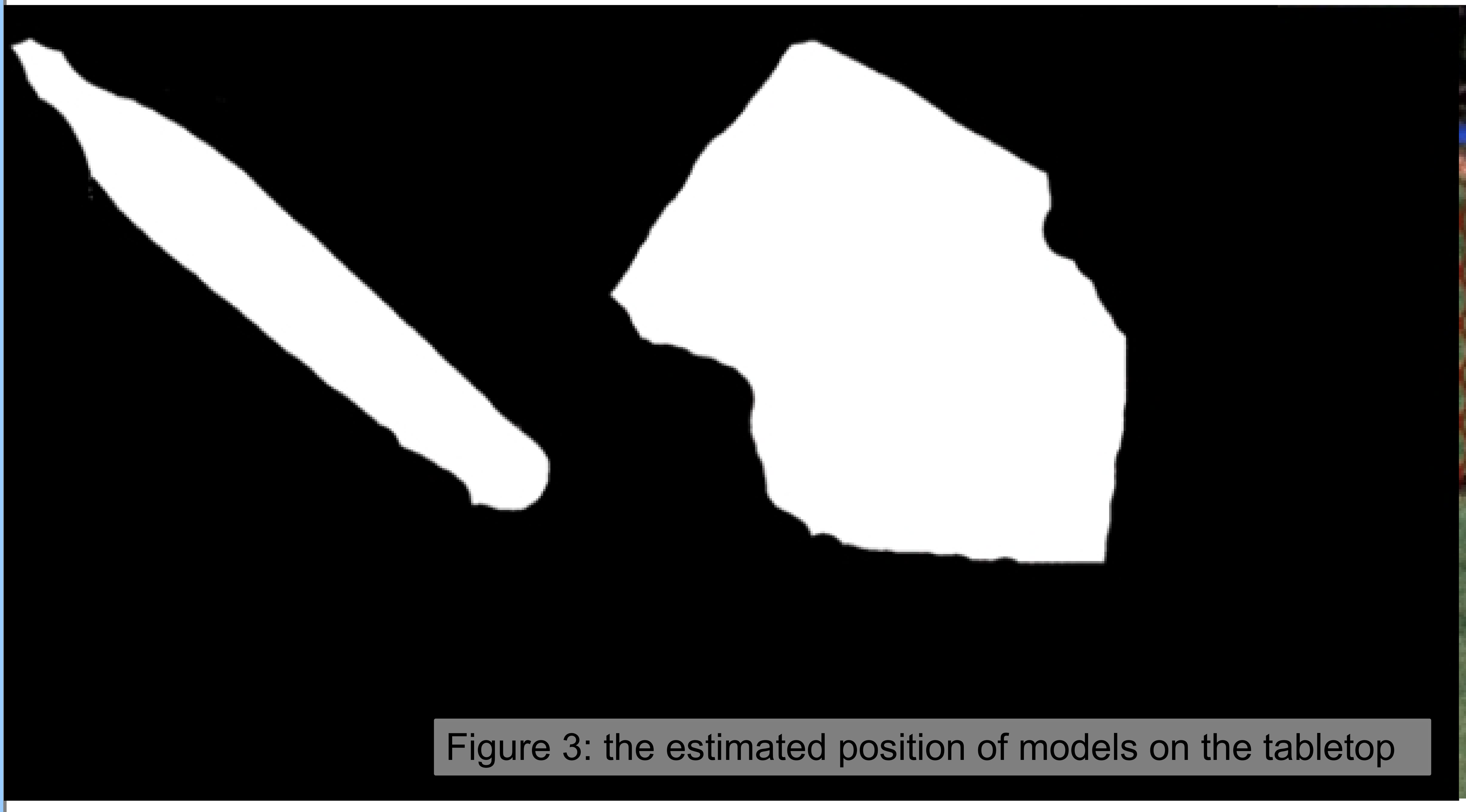

Figure 3: the estimated position of models on the tabletop

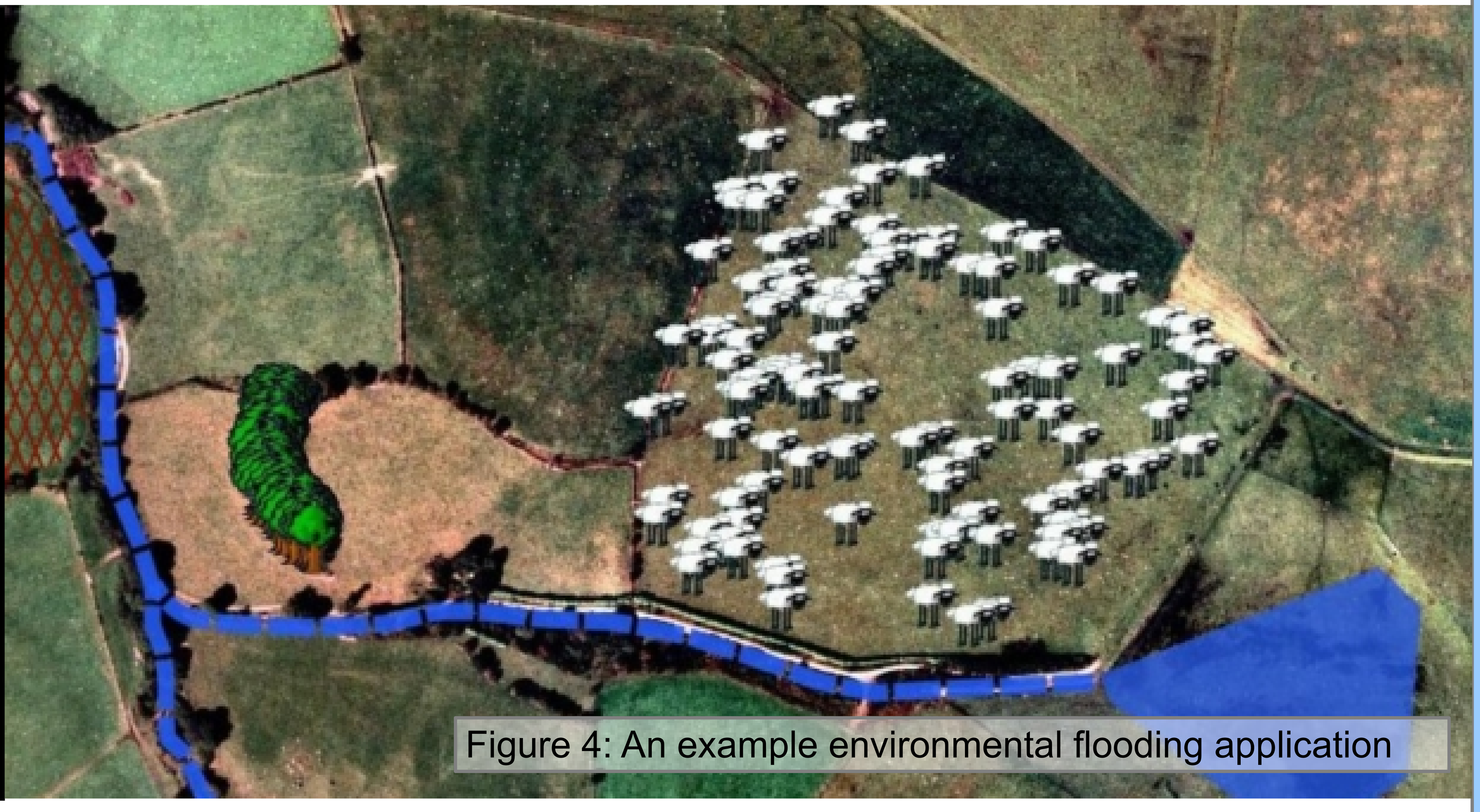

Figure 4: An example environmental flooding application

The surface is considered to be ground zero and by subtracting the gradient from the depth map we are able to estimate the location of any objects above the surface. OpenCV (opencv.willowgarage.com) was used to warp the 2D image to the corners to give us an approximation of where the objects are on the tabletop (figure 3). We have used the table with our flood management and stakeholder engagement tool, Jimilee [2]. Here, stakeholders can explore the simulated environment by adding objects onto the table to control different parameters. By increasing the numbers of sheep or trees in that area, different flood mitigation scenarios can be explored. By projecting the landscape onto the tabletop stakeholders are able to add objects naturally into the fields to represent sheep or trees, and the impact on flooding can be seen in real-time (figure 4) without having any knowledge of the complex simulation.

Conclusions

Pairing the Kinect controller with a 3D projector let us build an inexpensive and flexible system for interacting with a 3D environment. The Kinect simplifies the tasks of identifying objects considerably, and the depth information allows true 3D interaction with the projected image. Many uses can be found for such a system and in this poster we have demonstrated our tabletop display using example application, which is designed for interacting with stakeholders by demonstrating the affects agriculture can have on the environment.

Although our calibration provides a good estimate of objects above the surface the Kinect requires an unobscured view of the table to prevent occlusion. Results are improved where the kinect is tending to an overhead position, as both objects are less likely to occlude smaller objects and the perspective of the view is less distorted.