A Tabletop Computer Interface Using A Depth Camera

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Introduction

- Objective is to create a low cost "touch screen" that can scale to large sizes
- Touch is detected using computer vision with a depth camera
- A depth camera can tell distance from the camera using trigonometry at each pixel to create an image
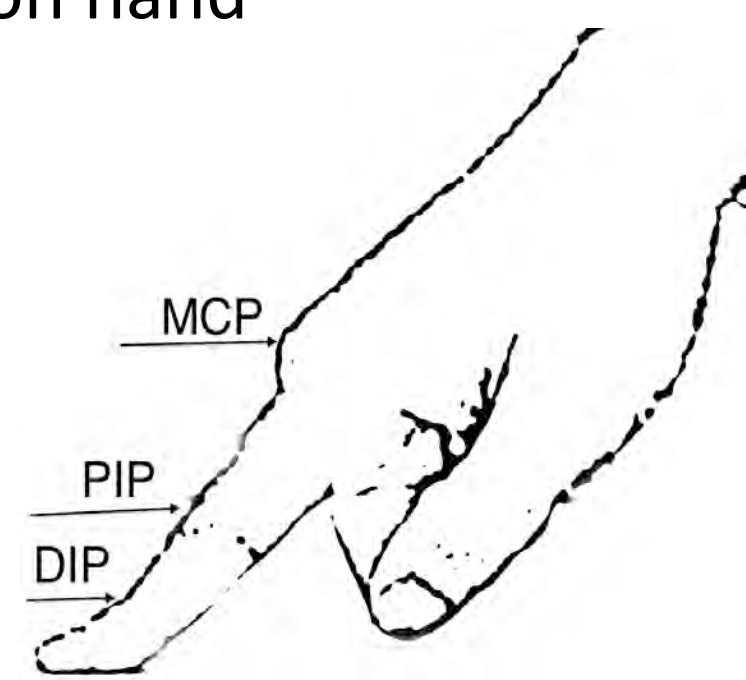- Using geometry can map tabletop with depth camera image

Tabletop Construction

- Table is 4 ft x 2 ft x 3ft
- Camera is 3 ft above the tabletop
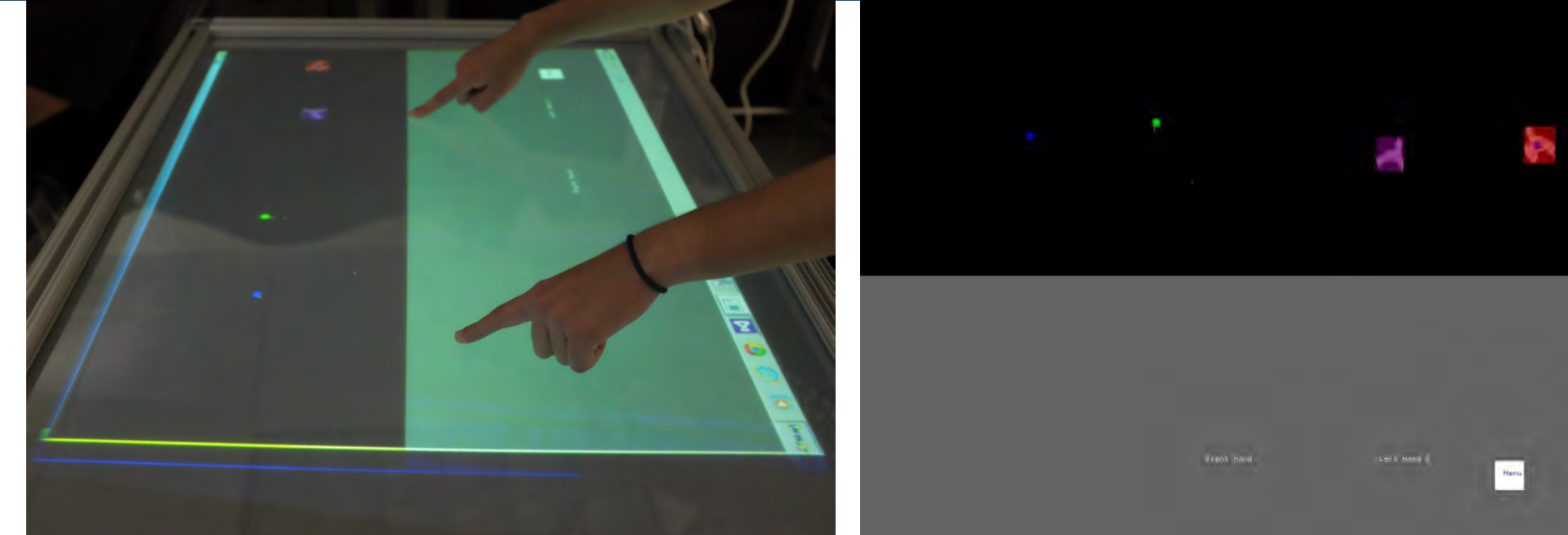- Use video projector and mirror to display image on tabletop

Hand Measurements

- Conducted experiment to test how users would interact with a large touch screen
- Collected measurements for threshold distances at 3 points on hand
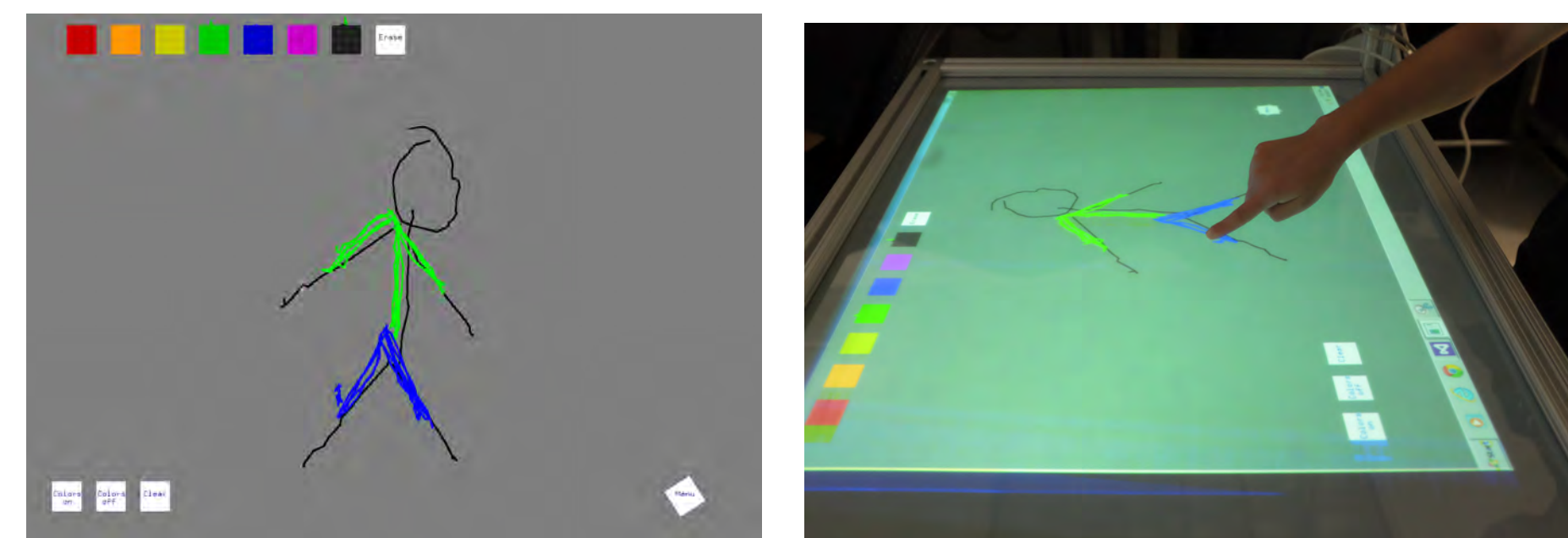 - Male measurements should be used in design
  - All common hand positions can be detected by image processing


Touch Detection

- Threshold two regions of the hands: finger tips and top of hand
- Can determine if user used their left or right hand to touch
- Calibration is needed to map corners of screen to depth image
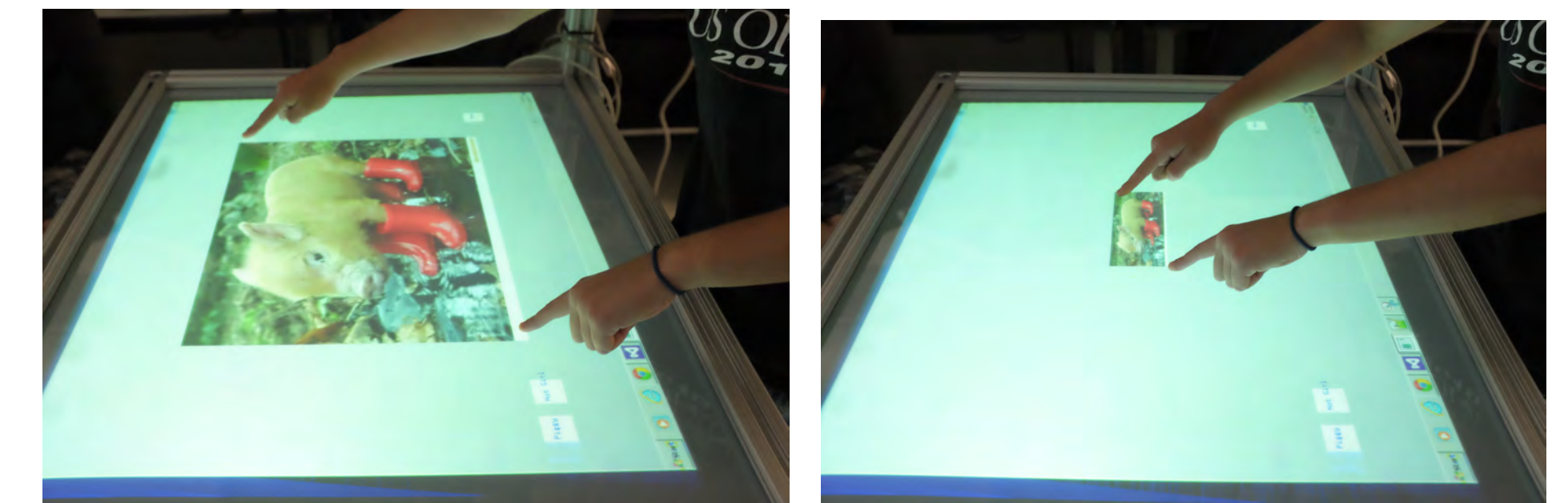
Drawing Application

- User can use 1 or 2 fingers to draw on screen
- Drawing works by creating a 3x3 pixel line at start and end touch points
- Provide color options, a clear button and menu button to use the application
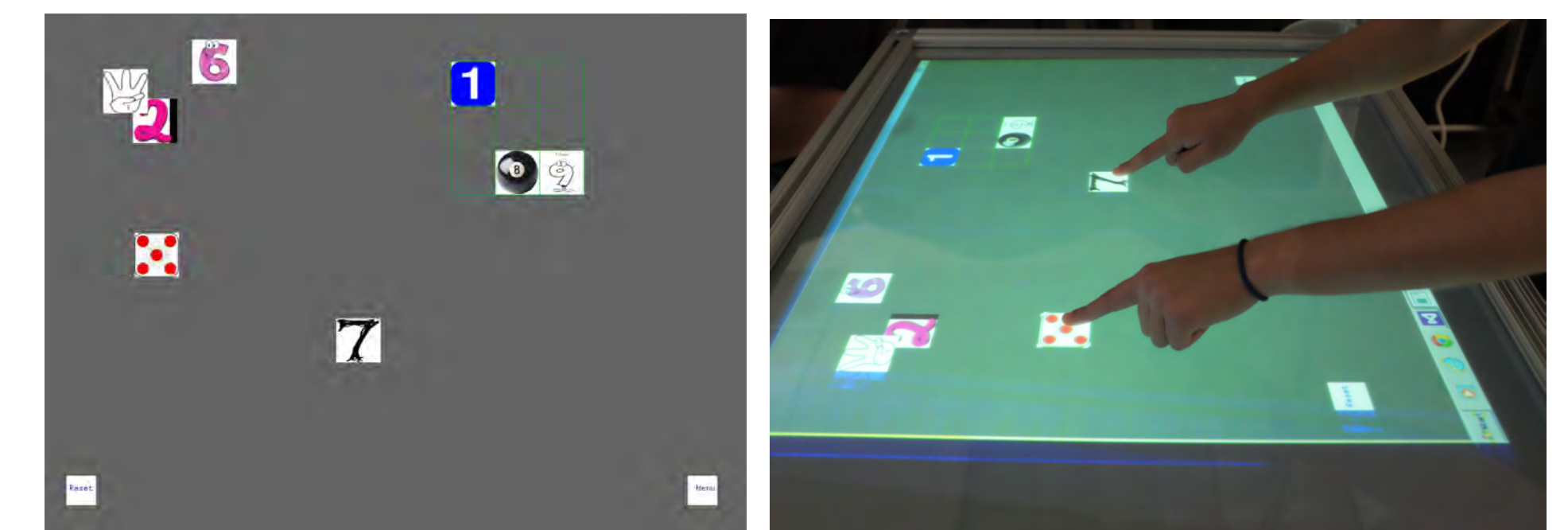- Graphics done in OpenGL

Swipe Application
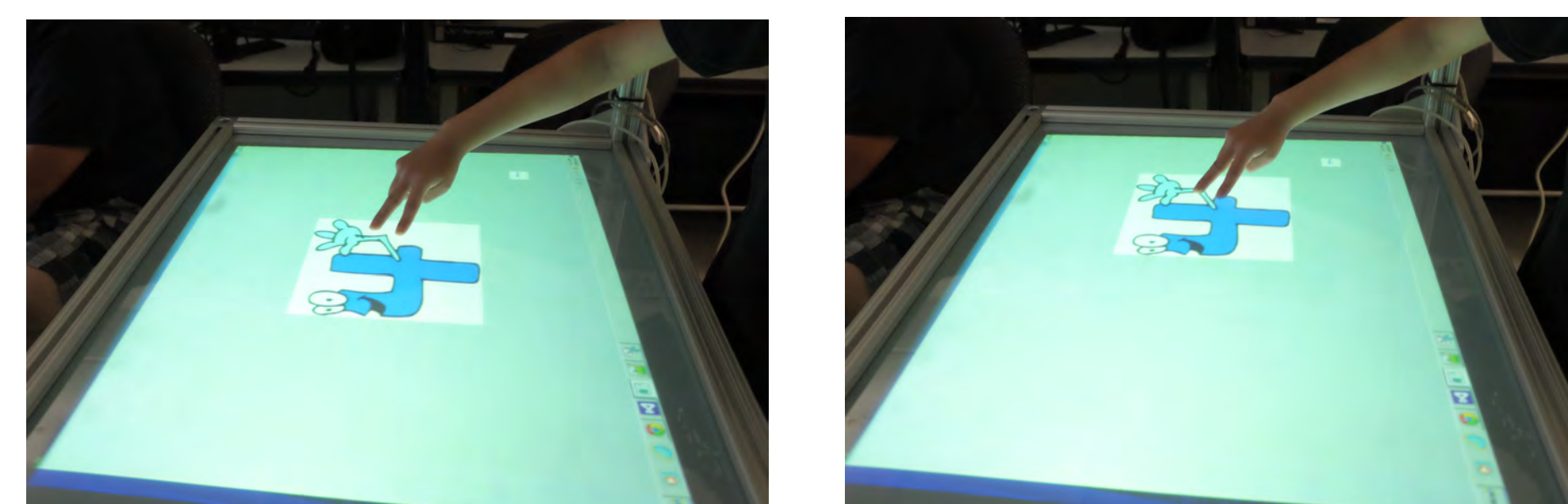
- Two gestures created to detect swipe: two finger swipe and hand hover over table

Zoom Application

- Images can be resized based on the location of the two fingers
- If two fingers are detected, the image resizes to the difference between the x and y coordinates from the finger locations

Puzzle Application

- The puzzle can use one or two fingers
- Pieces snap into a 3x3 grid in numerical order

Conclusion

- Applications written in C++, OpenCV and OpenGL
- Proved that the Kinect is a viable option for a large scale touch screen
- Kinect provided accurate tracking of fingertips using blob detection
- Can detect multiple blobs
- Work is needed to improve differentiating blobs
- Calibrated the systems to have a one-to-one mapping between depth image and physical table location
- Next step is to explore more specific hand gestures