2016

KinectVision360: A Real-time Human Tracking System

Robert Ha
Virginia Commonwealth University

Ravideep Marwaha
Virginia Commonwealth University

Joseph Crouch
Virginia Commonwealth University

Team Members: Robert Ha, Ravideep Marwaha, Joseph Crouch

Faculty Adviser: Carl Elks, Ph.D., Yuichi Motai, Ph.D.

ELECTRICAL AND COMPUTER

KinectVision360

A Real-time Human Tracking System

CAPSTONE DESIGN EXPO 2016

Introduction

The KinectVision360 project integrates multiple Microsoft Kinect sensors to investigate the capabilities of the low cost human interactive device to apply them to modern problems in comparison to high cost devices. The project includes human face/skeletal tracking and a larger field of vision.

Overview Models

The project includes three Kinect Sensors (1st generation) and a custom computer with components necessary to process large amounts of data in real time. The hardware model setup is shown in Figure 1. The software model is shown in Figure 2. The model presents an overview of the processes that the program follows in order to execute and visualize the data for tracking.

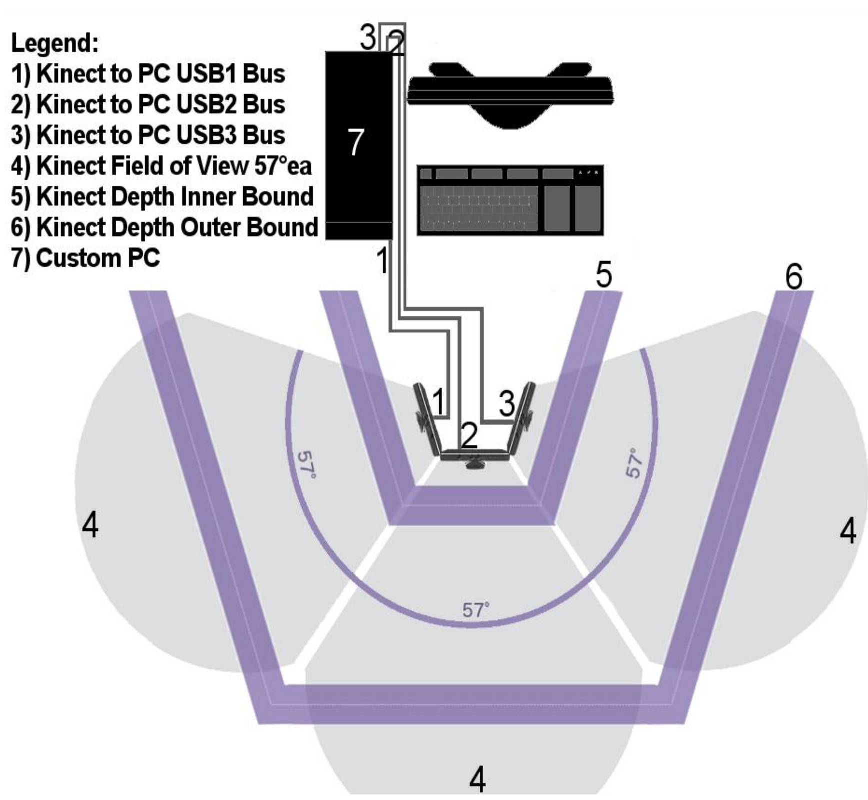


Figure 1 – Overview hardware model of multiple Kinect sensor setup.

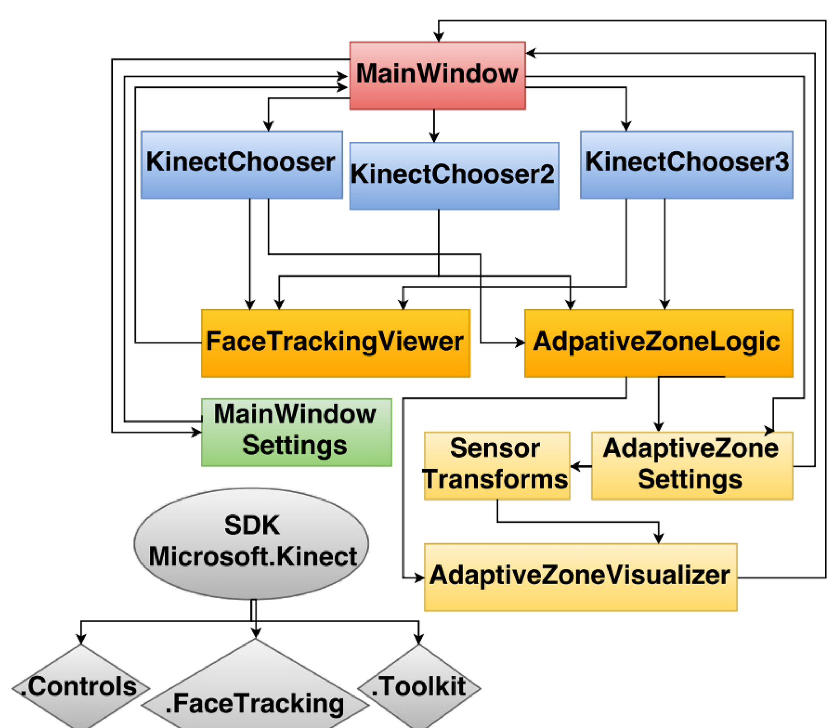


Figure 2 – Overview software model of the C# program.

Face & Skeletal Tracking

The Face Tracking Class contains the algorithms and logic to retrieve skeletal information from the infrared depth sensors in the API. In a two-stage process, body position is understood by calculating a depth map with structured light and then inferring the body position using machine learning. Microsoft's machine learning is trained with over a million samples using a decision forest. The group enhances the tracking by rejecting poor construction of skeletons or faces. The faces are constructed using common facial features to produce an accurate model within the API. The class also transfers data between the sensors to allow for them to communicate that these are the same figures.

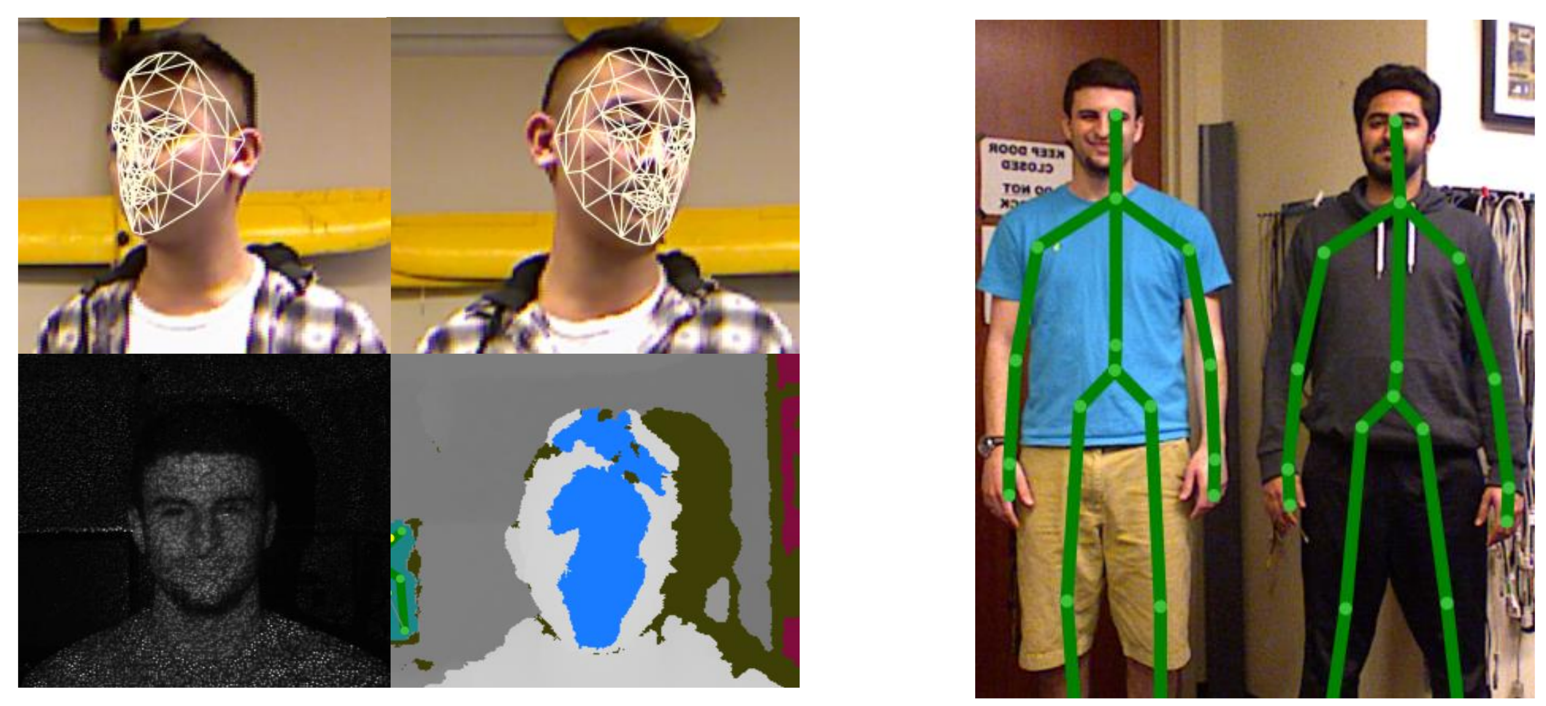


Figure 3 – Visual Face Tracking(Left) & Skeletal Tracking(Right) using Infrared and Depth Sensors.

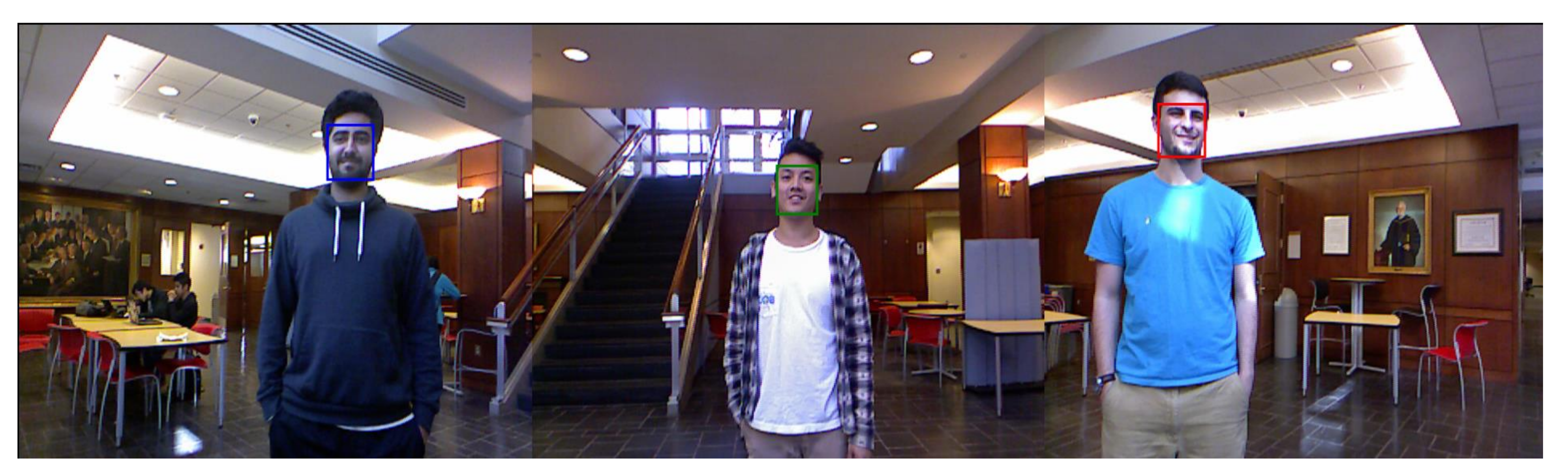
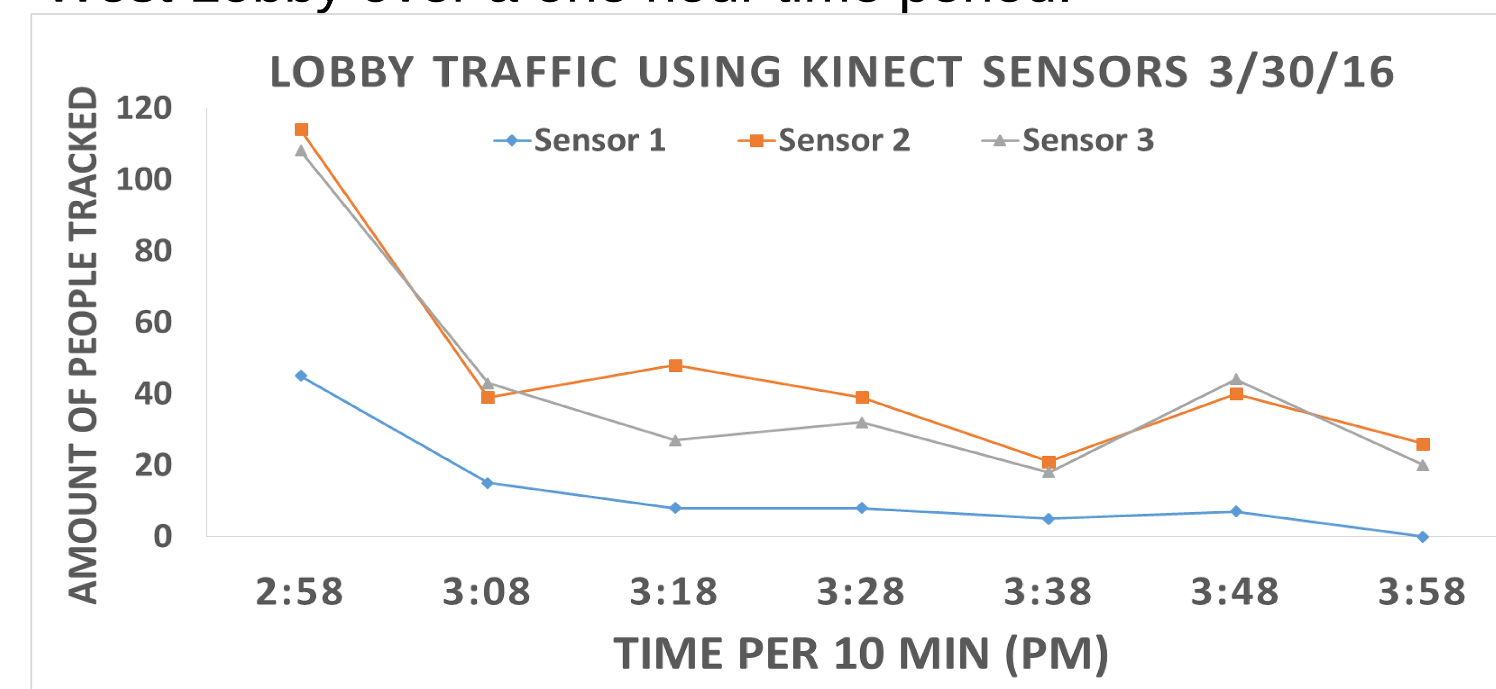


Figure 4 – Demonstrates Face Tracking capability across integrated sensors simultaneously. Notice each face is a different tracking color representing person identification.

Chart 1 – Shows persons tracked in VCU Engineering West Lobby over a one hour time period.



As shown, using Face Tracking we can analyze real-time data and visualize the data as it's being recorded.

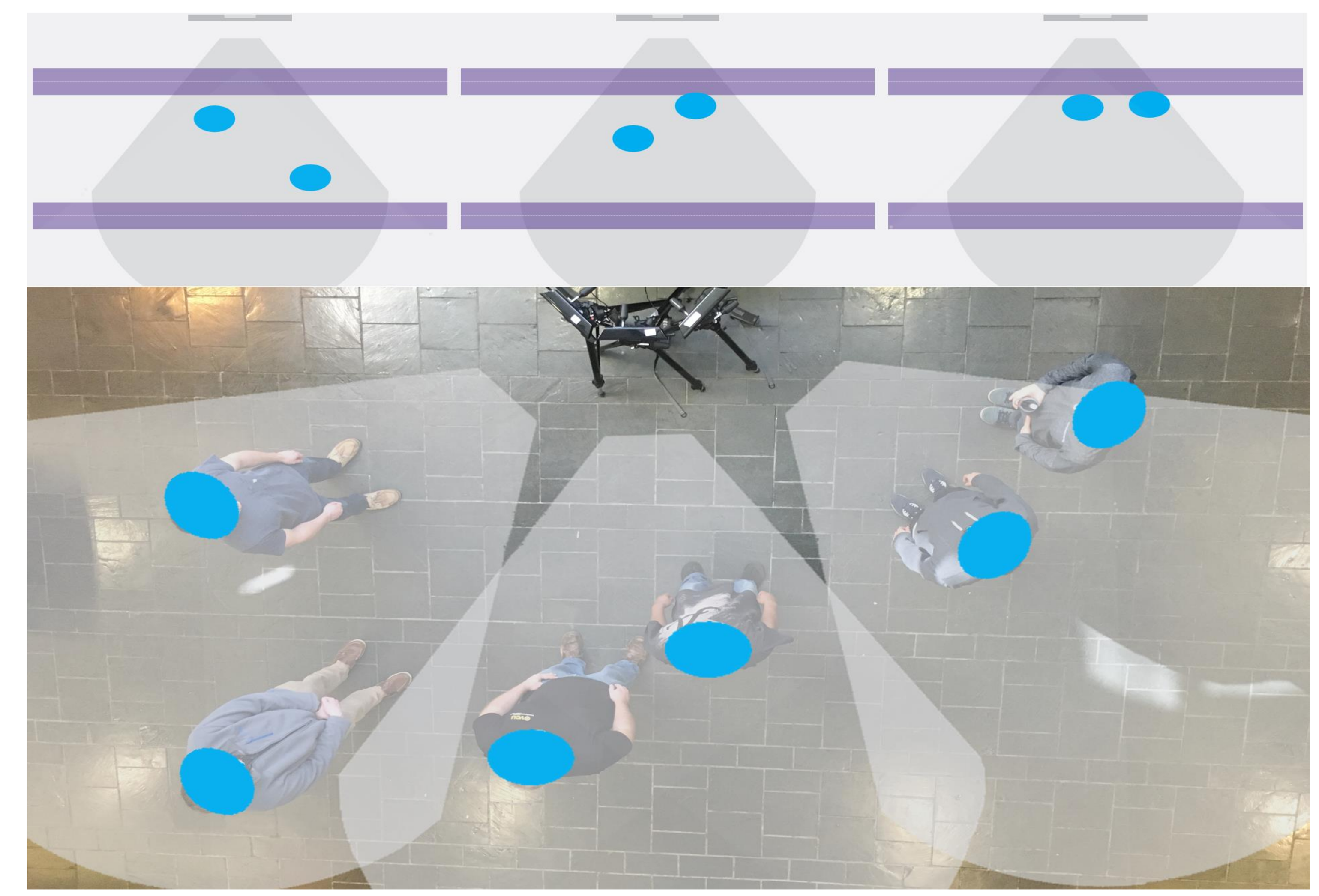


Figure 5 – GUI output in real-time image overlap illustrating the field of view functionality using depth.

Acknowledgements

We thank Dr. Motai for guidance and providing a lab to work in.