Hyperlocal: using sensors to study public space

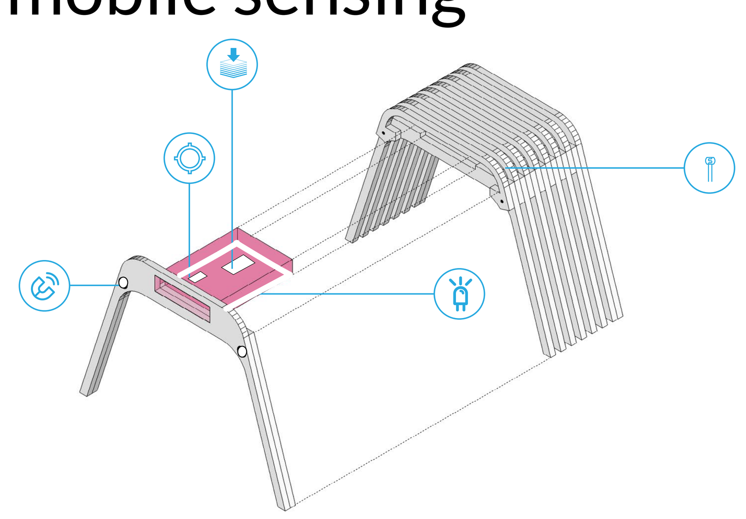
Mario Giampieri, Sarah Williams, Wenfei Xu, Hayrettin Gunc, Christine Langston, Dennis Harvey
MIT Civic Data Design Lab

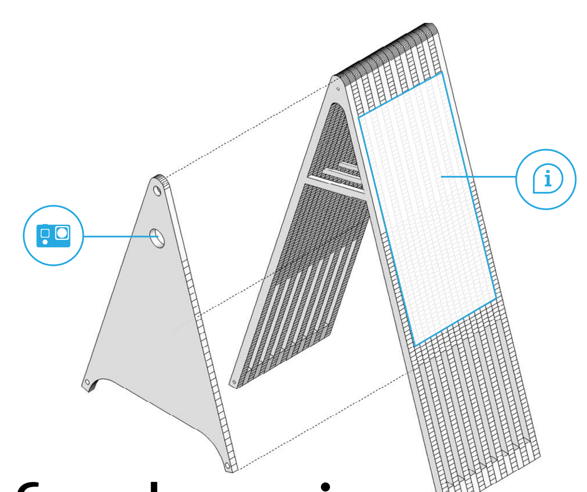
Introduction

Efforts have been made throughout history to measure how people use public space. This research seeks to integrate a range of sensor technologies to automate analysis of pedestrian usage of public space. A range of environmental sensors, image recognition utilities, and open-source software are combined to create a system to measure in detail how people use public space, with the intention of serving as a tool for creating better public spaces in the future.

Sensing was divided into local and site-wide categories. Mobile sensing was achieved through using force sensors, magnets, GPS, and photosensors. Fixed sensing was achieved through the use of a camera and image recognition packages. This poster details the fixed sensing.

mobile sensing

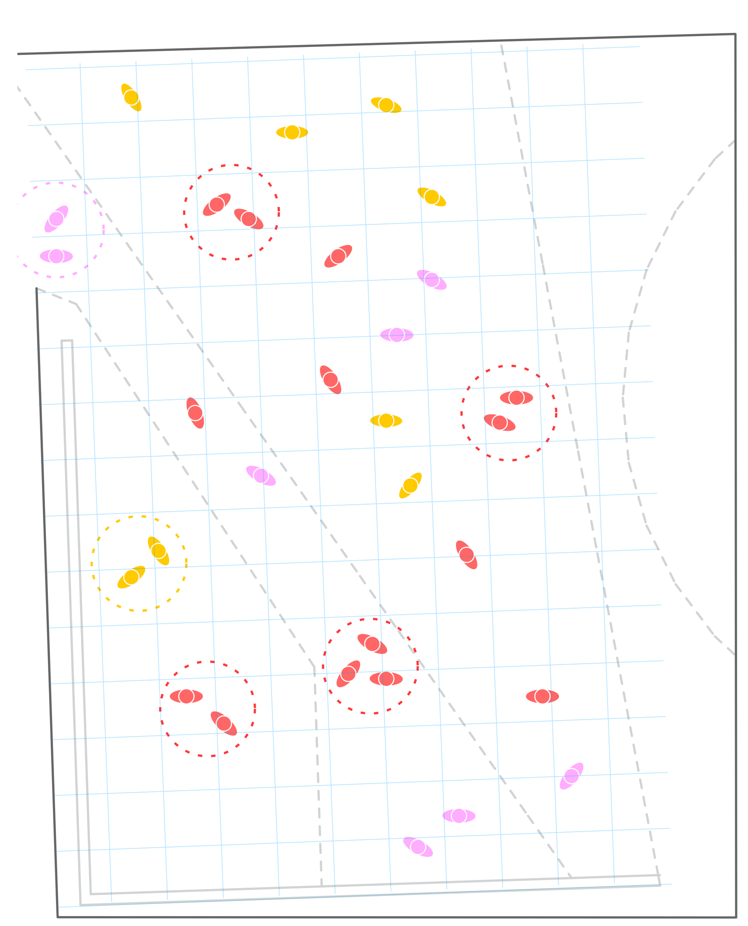




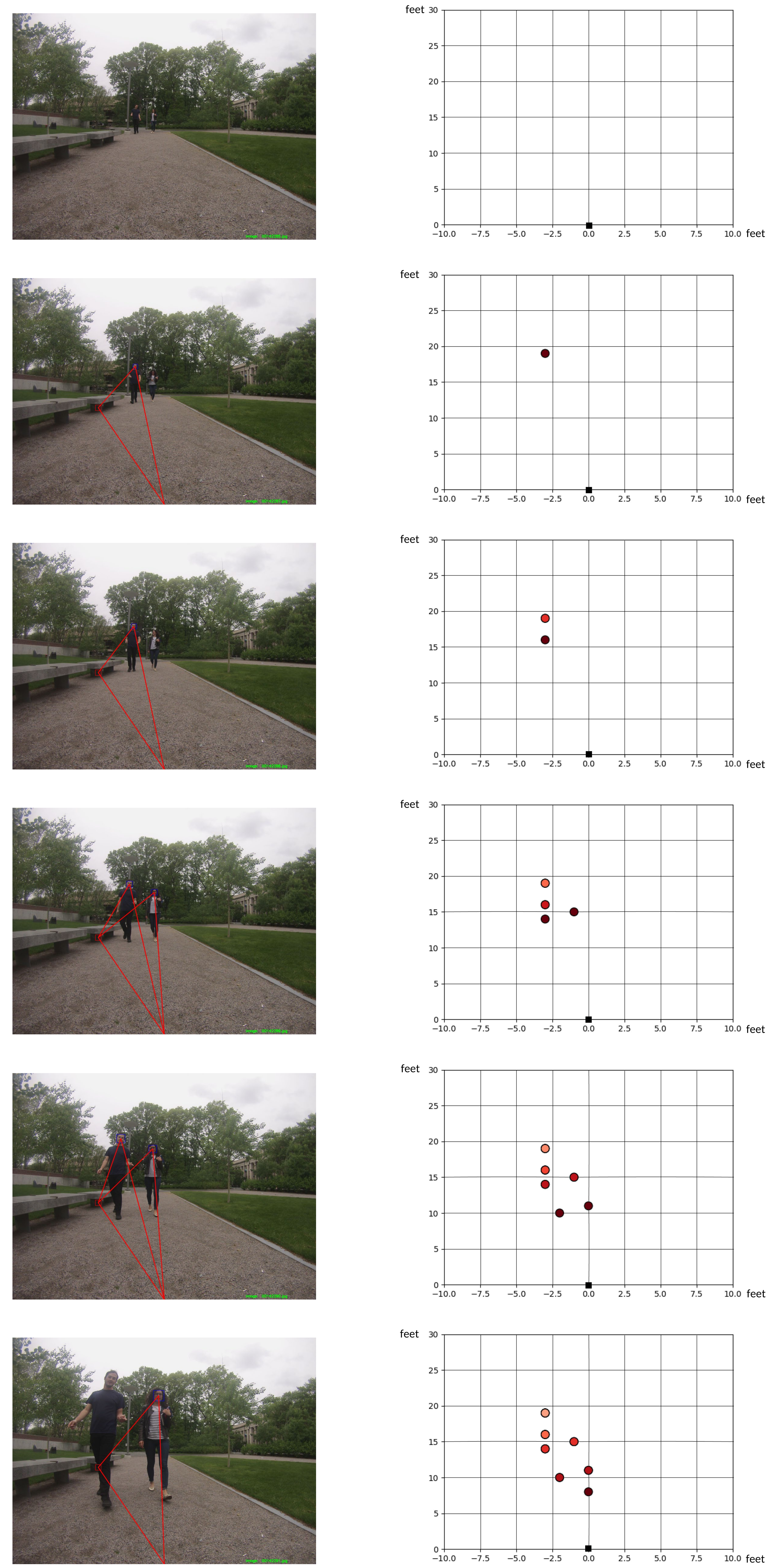
fixed sensing

Methods

A number of fixed information boards were placed throughout the site, each outfitted with a GoPro camera attached to a Raspberry Pi model-B. OpenCV 3.2.0 (opencv.org) was used to identify human faces from video feeds and estimate the location of the persons in the video feed relative to the camera.



Example scenario showing pedestrian detection and position relative to camera in feet



Results

Positive pedestrian detection was achieved in about half of images collected in the two week trial period. The images and plots (created using Pandas Python library: pandas.pydata.org) to the left illustrate a typical scenario where pedestrians are detected within 30 feet of the camera. The boxes drawn around faces denote positive detection, and the lines represent the geometries used to calculate relative distance from the camera.

Locations are reported relative to the camera in a two-dimensional plane. Reported pedestrian locations were within one foot of measured distances in test scenarios, suggesting promise for this method once higher detection rates are attained through iteratively training the classifier. Translating from relative to geographic coordinates is straightforward and is an area of future development.

Discussion

Our application focuses the potential of computer vision software toward understanding how people use public space in concert with other local sensors and place-making interventions. This combination will enable urban planners and designers to study public spaces effectively and at a wider scale than before. This solution is low-cost, and relies upon easily available materials and open-source code[1], suggesting that organizations interested in studying public space (and arguing for place-making interventions) can do so more easily than by using traditional methods. An ideal use case would be analyzing an area before and during a temporary intervention to demonstrate the benefits of peace-making interventions and to help make such interventions more permanent.

1. OpenCV team, 2016. Open Source Computer Vision Library. www.opencv.org.