The Collaboration of Intersections and Technology

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CENTER FOR SMART STREETSCAPES

Introduction

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- Manhattan
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- Engineering

The Goal

Through research and experimenting with simulation technology, we discover possible solutions for improving the design of intersections to increase the safety and efficiency of travel for cyclists who travel on intersections.

What to Expect

- The Research Methods
- Overview of Why Intersections Need a Redesign
- The Purpose and Defense of Smart Intersections
- Issues Concerning Cyclists in Intersections
- Solutions to Cyclist Intersection Issues
- The Software behind the Hardware
- The Progress of the Process

Methods

Literature Review

Site Visit

Simulation

Source	Author	Problem	Solution	Findings	Methodology
Bike Lane Obstructions in Manhattan, New York City: Implications for Bicyclist Safety (2019)	Corey H. Basch, Danna Ethan, and Charles E. Basch	Bike lane obstructions are common and pose a safety risk to cyclists. The three types of obstruction include vehicle, pedestrian, and object obstruction.	Monitoring the presence of obstructions in bike lanes with sensor technology could help in indicating locations where bicyclists are most likely unsafe. Also, implementing policies with obstructions in bike lanes such as police giving tickets to vehicles in the bike lanes would help promote bicyclists safety.	Objects made up 53.2% of the 233 obstructions reported in the study. People accounted for 28.3% and vehicles accounted for the remaining 18.5%.	Bicycle obstruction was observed in 10 zones of Manhattan in 2018 with attention being only given to protected bike lanes since they were deemed as lanes only meant for bike travel.
A hazard-based duration model for analyzing crossing behavior of cyclists electric bike riders at signalized intersections (2015)	Xiaobao Yang, Mei Huan, Mohamed Abdel-Aty, Yichuan Peng, Ziyou Gao	Many cyclists and electric bike riders run against the red light intersections, so we want to know what causes them to ignore the light and when they will ignore it.	Using a hazard-based duration model, many factors that influenced cyclists behavior at intersections were investigated. 1144 cyclists and 1178 e-bikers were observed in Beijing, China, and the data was analyzed to pinpoint the factors that affect riders.	The waiting time was the most influential as to whether a rider would cross the red light or not. More than half of the observed riders could not wait 49s or longer. Only 25% of the riders were able to endure 97s or longer. E-bikers also had higher	They experimented by observing a certain number of cyclists and e-bikers, later analyzing all the data and implemented some surveys, making inferences based on the data they acquired.

SUMO

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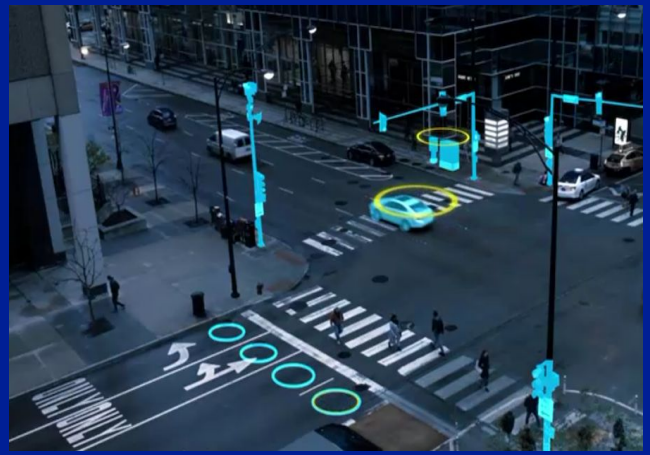
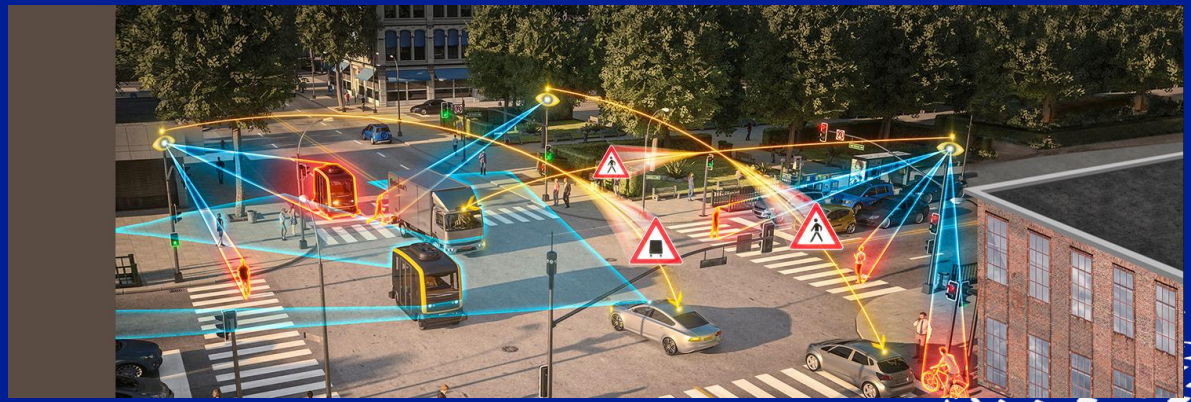
Modern Intersections

Intersection - In terms of streets this is the location where two or more roads meet each other.

Incoming Smart Intersections

Smart intersections refers to intersections that have been adapted with certain technological features that make them more reliable for safe and efficient travel for people using any form of transportation.





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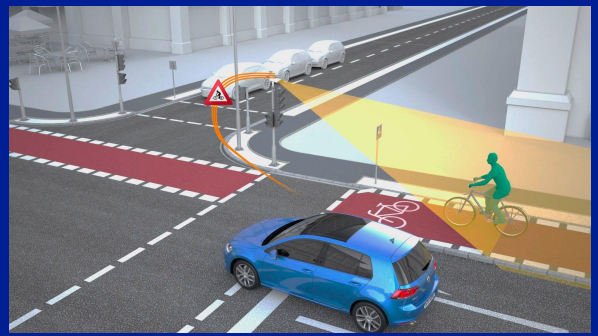
Benefits of Smart Intersections

- Contextual awareness of intersections through birds eye-view cameras
- Analyzing situations at intersections to provide rapid notifications to oncoming vehicles
- Updating traffic light cycles in real time to prevent congestion



Trust in Smart Intersections

Concerns with Smart Intersections:

- The fear of leaking private information
- Is sensor technology fast enough?
- Security issues with the transference of personal information

Resolutions for Smart Intersection Concerns:

- Anonymization pipelines
- Use of Contemporary GPUs along with NVIDIA TensorRT and Deep Stream
- Blockchains and smart contracts

Cyclist issues

- Obstructions

- Communication/Signaling Insufficiency

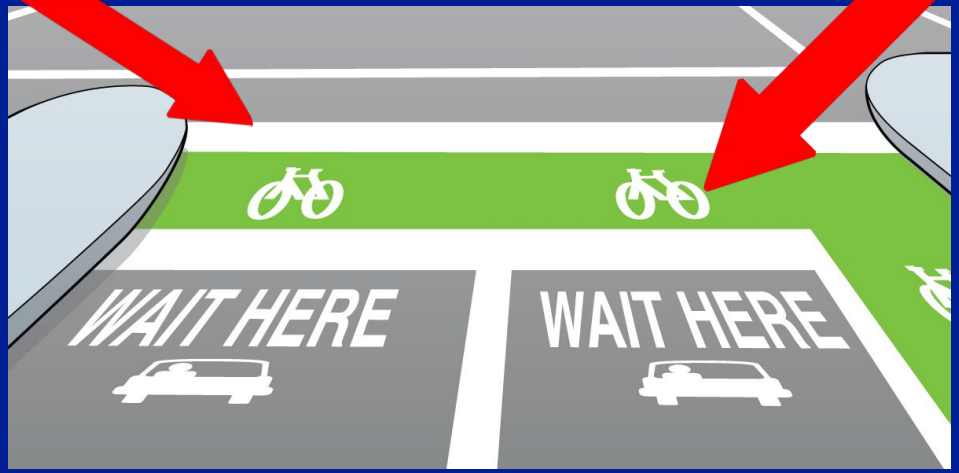
Solution #1

Bike Boxes

Bike boxes - marked boxes at intersections that provide a visible path for cyclists

Design

- Stop lines for drivers so they enter
- Bicyclist centered in the box for it to be identified



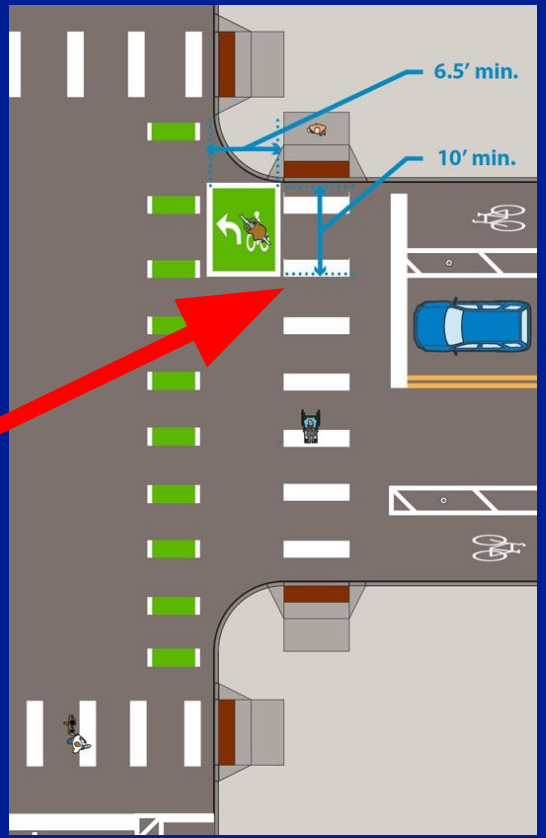
Solution #2

Two-Stage Turn Queue Box

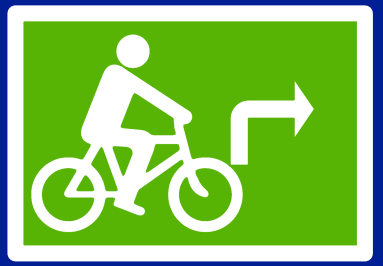
Two-Stage Turn Queue Box - gives bicyclists directions on turns at an intersection

Design

- Placed in a protected area; same lane as on-street parking and between bike lane and pedestrian crosswalk.

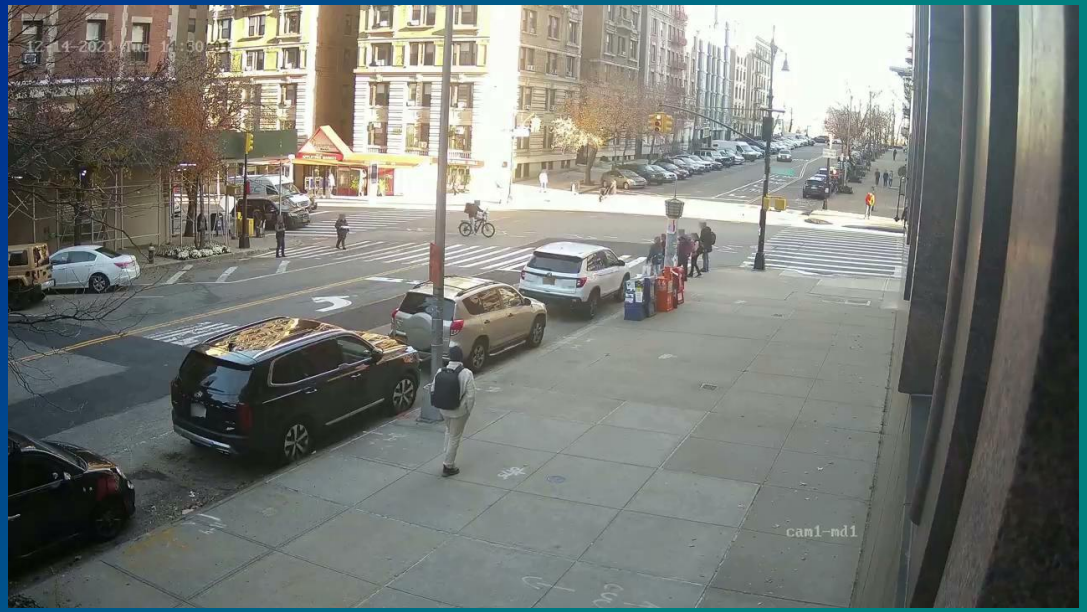


- Consists image of bicycle and a turn arrow properly indicating the direction and positioning of a cyclists wishing to turn.



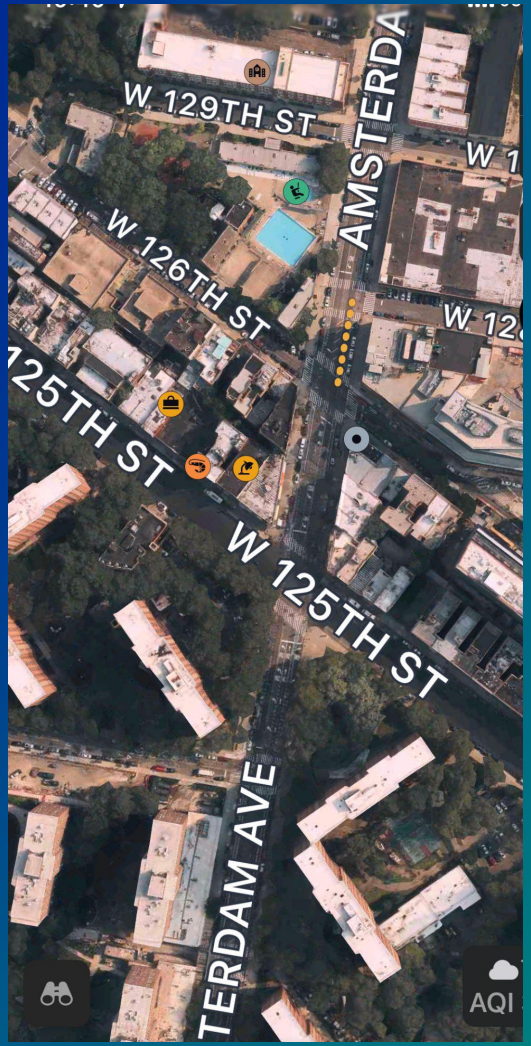
Real-world Data

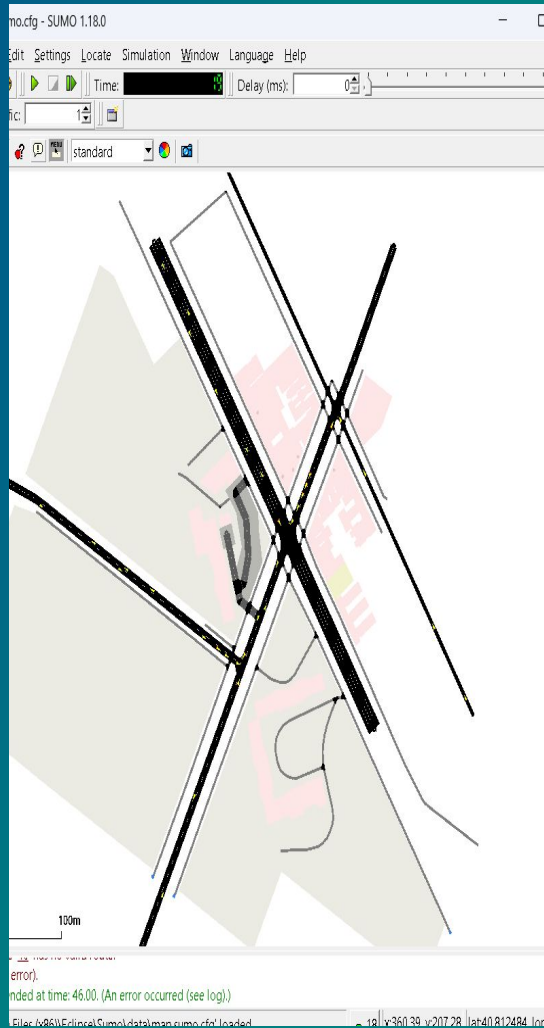
Yolo - object detection algorithm



Technology Tests True

SUMO - Simulation of Urban Mobility
An open source, portable, microscopic and continuous multi-model traffic simulation package.





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Next Steps

- Implementing data from algorithm into simulation
- Analyzing the effects of the changes made onto the intersection
- Execute designs in real intersections

Acknowledgements

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ENG Experience

Thank You!

Any Questions?