PREDICTION OF REAL-TIME TRAFFIC SIGNAL CHANGES

Presentation to ITE Border Section

January 19, 2017

Autonomous Vehicles

- **Vehicle to Vehicle (V2V) Integration**
- **Vehicle to Infrastructure (V2I) Integration**
  - **Vehicle – Traffic Signal Communications**

Traffic Light Information System

- First Step in V2I Integration
  - EnLighten® by Connected Signals, Inc.
  - Traffic Light Information by Traffic Technology Services, Inc. (TTS)

Traffic Light Information System

- Free Service to the Driving Public
- Allows drivers to see how long to wait on RED
- Allows drivers to see how long GREEN they have

How Does it Work?

- Receives Real-Time Traffic Signal Data (via TMC)
- Uses a Predictive Model of Traffic Signal Changes
- Gives Drivers GREEN & RED time Predictions
  - Based on History
  - Based on Vehicle & Pedestrian Calls
  - Other Information

Why Do It?

- **Increased Safety at Intersections**
- **Improved Fuel Economy/Reduced Emissions**
- **Reduced Driver Stress**

- By Giving Drivers <u>Heads-Up (5 sec)</u> before RED time ends
- By Assuring Drivers that they have enough GREEN to get through the Intersection without Speeding
- By Alerting Drivers that they do not have sufficient GREEN time to make it through the intersection, thus avoiding unnecessary speeding

How to Get it?

- High-End BMW or Audi Model
- Smart Phone App (e.g. EnLighten®)

Connected Signals, Inc.

Matt Ginsberg

CEO, Chairman, & Founder, Connected Signals, Inc.

PhD, Mathematics (Oxford, 1980) at Age of 24

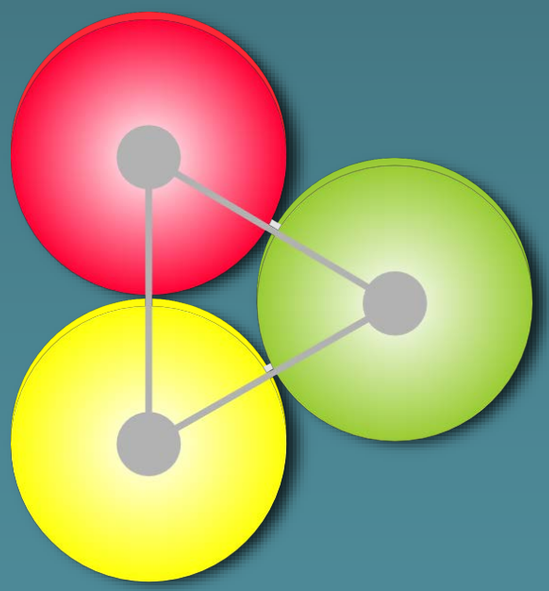
Author of ~100 Academic Publications (Artificial Intelligence)

https://www.youtube.com/watch?v=NRFETrOK6nU&feature=youtu.be

V2I*f*: Cars to Infrastructure on the Cheap

Matt Ginsberg

January, 2017



Connected Signals

See the light.

Connected Vehicles in the News

Why You Should Do This

1. Safety
2. Safety
3. Safety
4. Fuel, carbon, pollution savings
5. Driver stress

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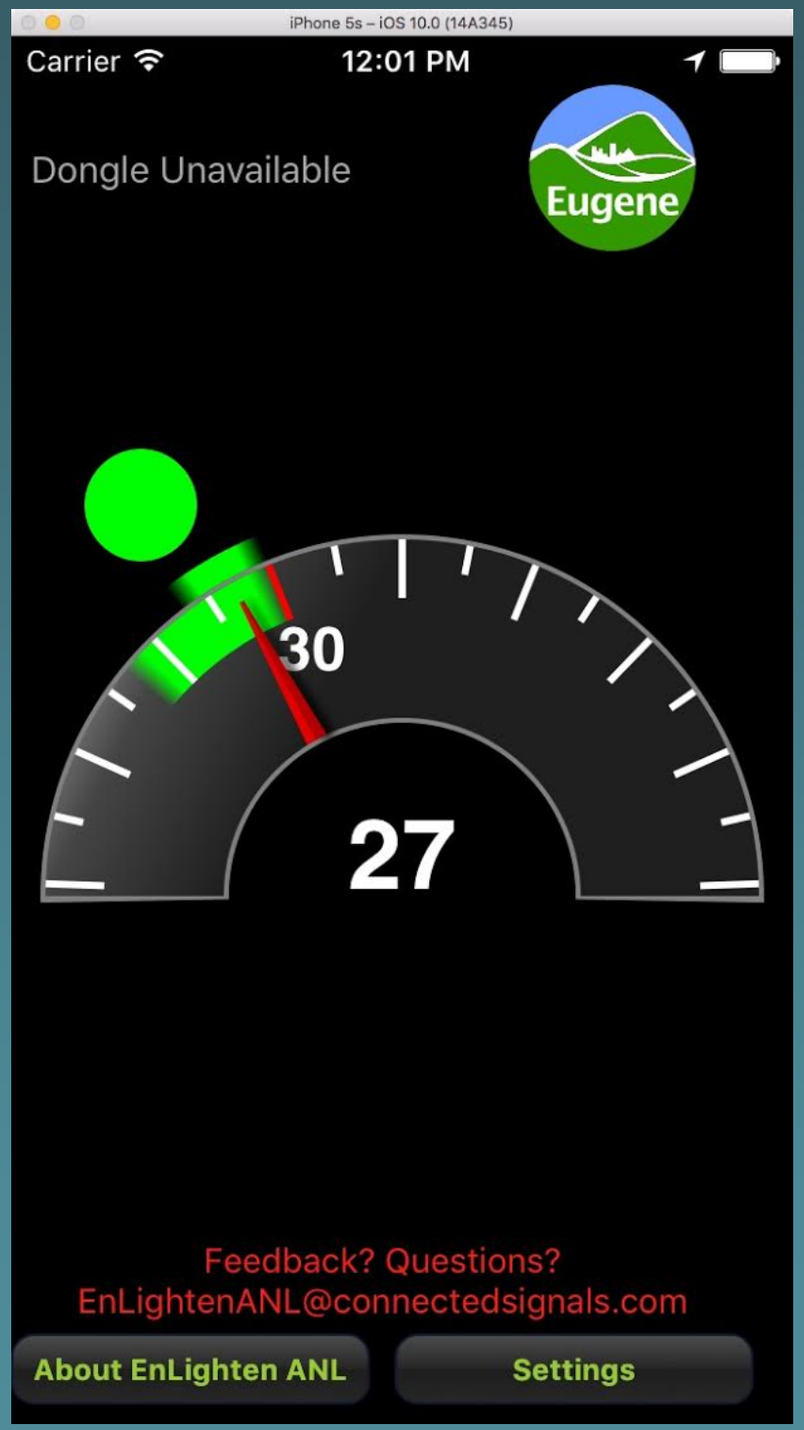
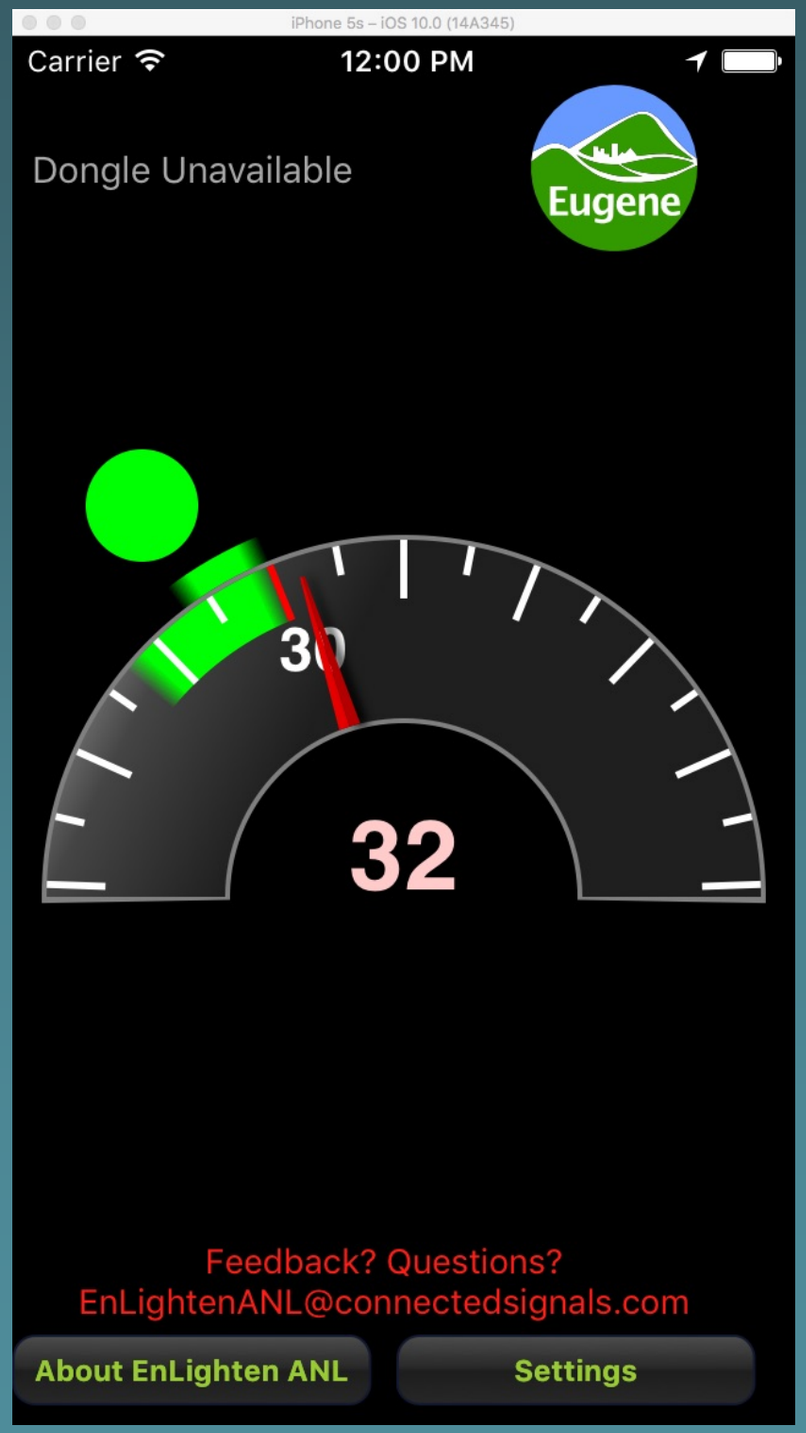


Why You Should Do This

1. Safety (chime on yellow)
2. Safety (don't speed up)
3. Safety
4. Fuel, carbon, pollution savings
5. Driver stress

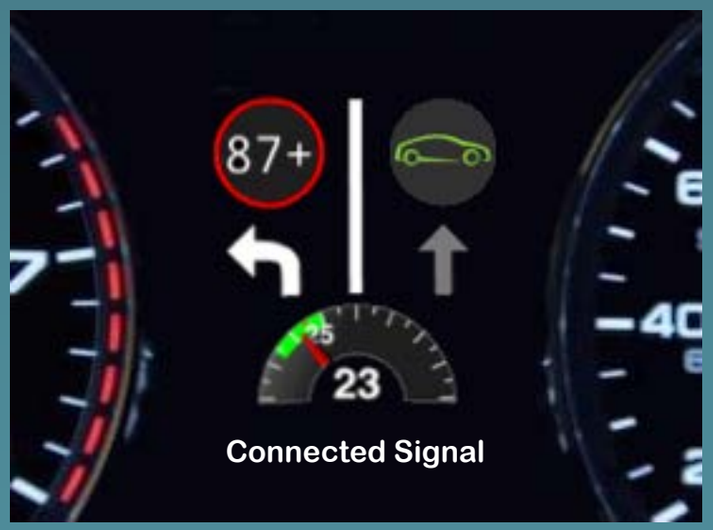


Why You Should Do This

1. Safety (chime on yellow)
2. Safety (don’t speed up)
3. Safety (slow down)
4. Fuel, carbon, pollution savings estimate)
5. Driver stress

Why You Should Do This

1. Safety (chime on yellow)
2. Safety (don't speed up)
3. Safety (slow down)
4. Fuel, carbon, pollution savings (10% estimate)
5. Driver stress



Why You Should Do This

1. Safety (chime on yellow)
2. Safety (don't speed up)
3. Safety (slow down)
4. Fuel, carbon, pollution savings (10% estimate)
5. Driver stress (red light countdown)

Argonne study under way

How Can You Do This?

- What we need
- What you need
- Process

What We Need

- Static data
  - Traffic light locations
  - Phase diagrams
  - Stop signs
  - Speed limits

What We Need

- Static data
  - Traffic light locations
- Dynamic data
  - Current phase
  - Vehicle and pedestrian calls
  - Timing plan
  - Preempts

What You Need

- Signals connected to a TMC
  - Some exceptions
- Software or hardware interface
  - Software: TransCore, McCain, Trafficware
  - Hardware: TransCore, McCain, Trafficware, Siemens, KITS, Intelight, Econolite
    - Requires connection by Ethernet
- Nonzero cost

Process

- Retain control of your data and of the applications that use it
- Ensure unbiased public access
- Protect security of your networks
- Minimize computational and network loads

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Process

- Retain control of your data and of the applications that use it
  - Our standard agency agreement is written exactly this way
  - You can unplug the device at any time

Process

- Retain control of your data and of the applications that use it
- Ensure unbiased public access
  - We will bounce your data to any third party you request
  - No charge to you or to them

Process

- Retain control of your data and of the applications that use it
- Ensure unbiased public access
- Protect security of your networks
  - First arrow configured at switch; second arrow uses outbound UDP
  - *No new packets on your network*
  - Outbound packets cryptographically signed

Signal switch

Process

- Retain control of your data and of the applications that use it
- Ensure unbiased public access
- Protect security of your networks
- Minimize computational and network loads
  - *10 bytes* per intersection per second

Raspberry Pi

Process

V2If Setup Checklist

✔ Procure Equipment

- ☑ V2If device received
- ☐ Check TMS settings (optional)

✖ Configure V2If

- ☐ Access the V2If configuration utility
- ☐ Remote host configuration
- ☐ Traffic light controller mapping

Connect V2IF to Network

Prerequisites:
- Configure V2If

Configure Firewall

Prerequisites:
- Configure V2If
- Connect V2IF to Network

✖ Send Static Data

- ☐ Light locations
- ☐ Phase mapping data

✖ Send Optional Static Data (optional)

- ☐ Shapefiles/Geodata
- ☐ Stop sign locations

Get Test Codes (optional)

Prerequisites:
- Configure V2If
- Connect V2IF to Network
- Configure Firewall
- Send Static Data

Summary

Our goal is to let you connect vehicles and:

- **Retain control of your data and of the applications that use it**
- **Ensure unbiased public access**
- **Protect security of your networks**
- **Minimize computational and network loads**
- **Not spend any money**

Questions?