

Some Analysis on Bus Data

Mobile Millennium Project

Kayvan Nowrouzi

MS Student, Mechanical Engineering, Control Engineering

Department of Mechanical Engineering

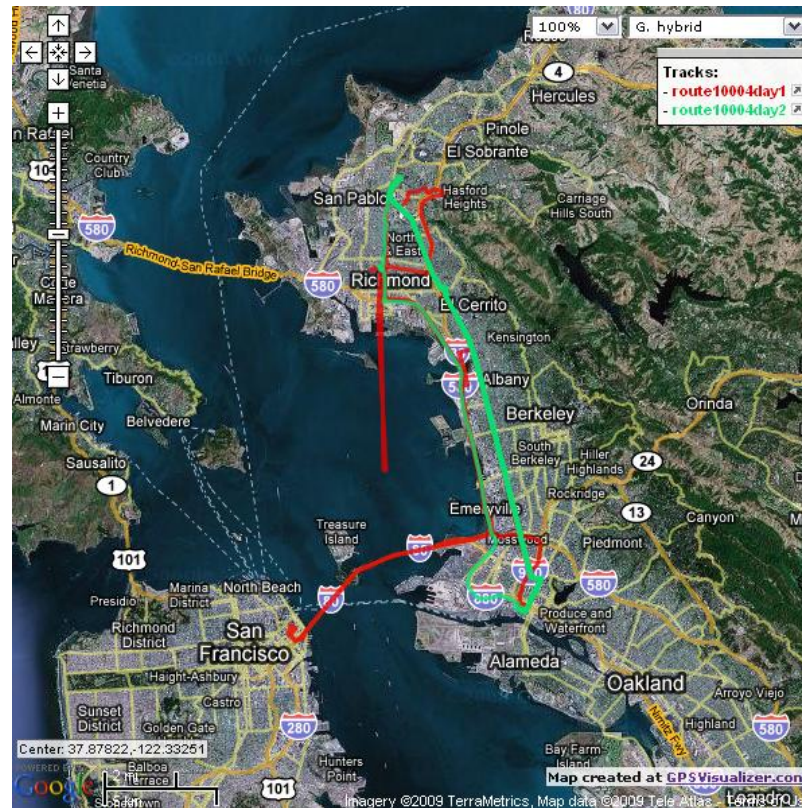
University of California at Berkeley

Goals

- To estimate the buses travel time between VTL's
 - Detect the bus stop locations.
 - Compute the travel time as if the bus wouldn't stop to load/unload passengers.

Procedure

- Analyzed data from 27 buses collected over period of one month:



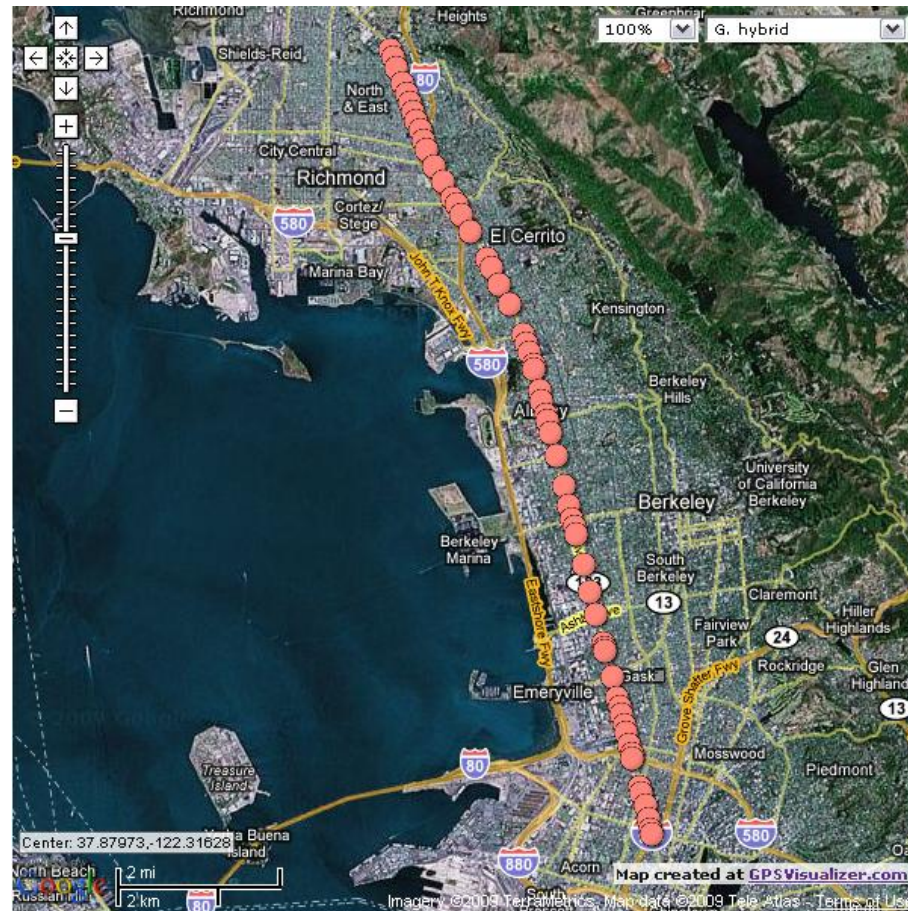
Procedure

- Data collected every one second.
- Lots of 'noise':

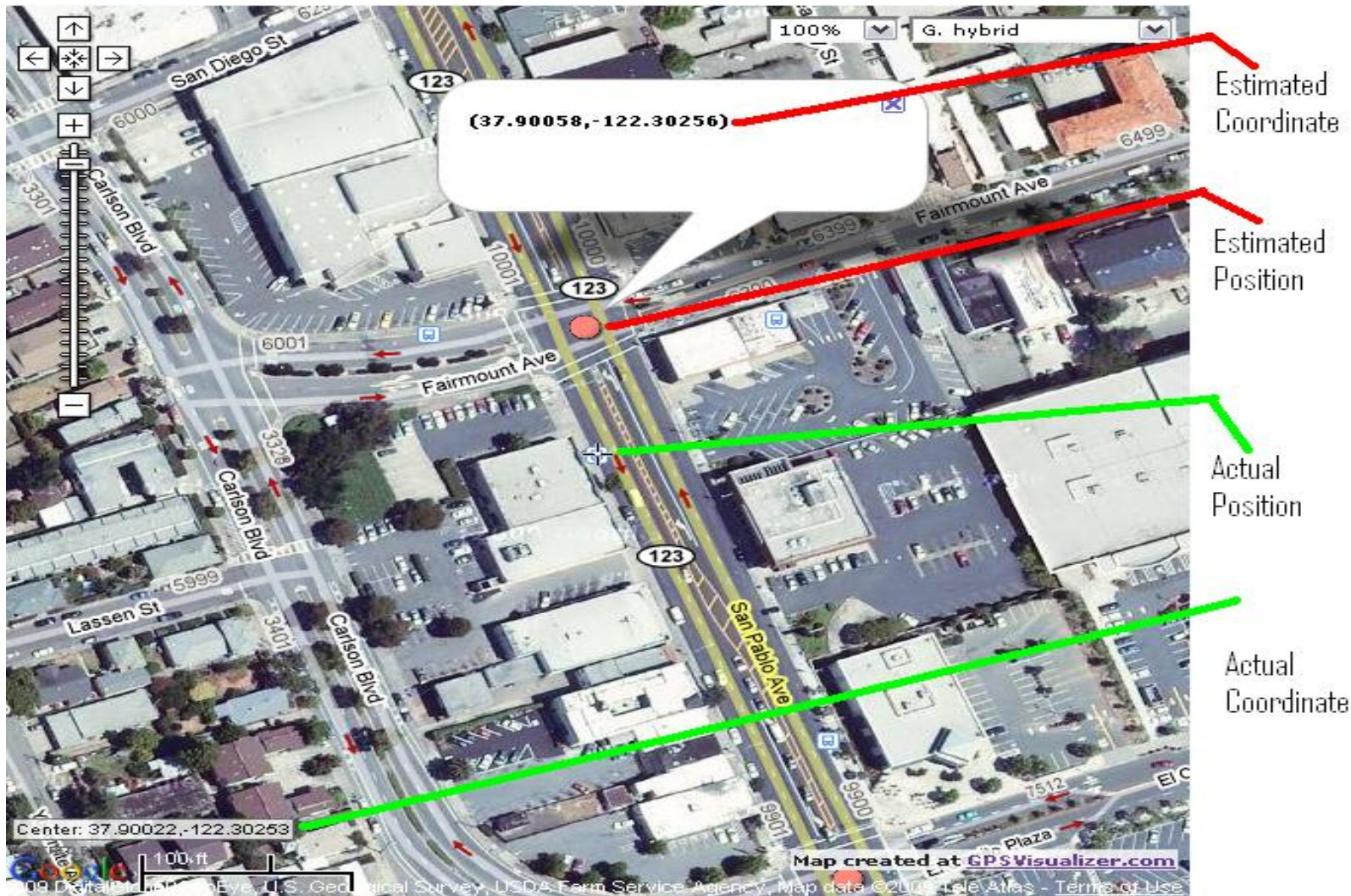


Procedure

- Provided with bus stop locations in a portion of San Pablo Avenue:



Procedure



Procedure



Suggested Algorithm

We start by defining the Followings:

- *Point1* is where the bus starts to slow down to make the stop at the bus stop
- *Point2* is where the bus reaches the speed that it would have if it hadn't made the stop to load/unload passengers.
- Two possibilities:
 - *Type1*: the bus stop is located in the middle of a road, or at an intersection with no traffic light
 - *Type2*: If the bus stop is located in front of an intersection

Suggested Algorithm

- Algorithm for calculation of travel time between two VTL's:
 1. Reset the timer once the VTL is crossed
 2. Start the timer while adding the intervals, i.e. $\Delta t_k = \Delta t_{k-1} + (t_k - t_{k-1})$
 3.
 - if the stop is of type1,
 - Estimate *point1* as the length of two buses, i.e. 2* 40ft, ahead of the stop location
 - Stop the timer when *point1* is crossed, and record the speed
 - Estimate *point2* as the length of two buses , i.e. 2* 40ft, away from the stop location
 - divide the distance between *point1* and *point2* by the averaged speed between the two points, i.e.

$$\Delta t_{point2} = \Delta t_{point1} + \frac{(x_{point2} - x_{point1})}{(v_{point2} + v_{point1})/2}$$

Suggested Algorithm

– If the stop is of type2:

- If the light is red when the bus arrives and remains red till the loading/unloading of the passengers takes place, no changes to the travel time.
- If the light is green when the bus arrives, and turns red when the loading/unloading takes place, subtract the time it takes for the light to turn green from the travel time. Also subtract the delay time of the bus due to lowering the speed from the travel time, i.e:

$$\Delta t_{delay} = \frac{2 * 40 ft}{v_{point1}} * 2$$

- If the light is red when the bus arrives, and turns green in the middle of the loading/unloading of the passengers, subtract ?? Seconds from the travel time
-

4. Add the time intervals to calculate the travel time. Go to (1)

To be done....

- Have to find a way of dealing with the noise in data, i.e. projecting points back to the roads



- Need to implement the algorithm in Java

To be done...

- Live feed of data is needed (still waiting to hear from them...)
- Exact location of the bus stops is needed
- Live feed of the traffic lights is required