Traffic Analysis Project

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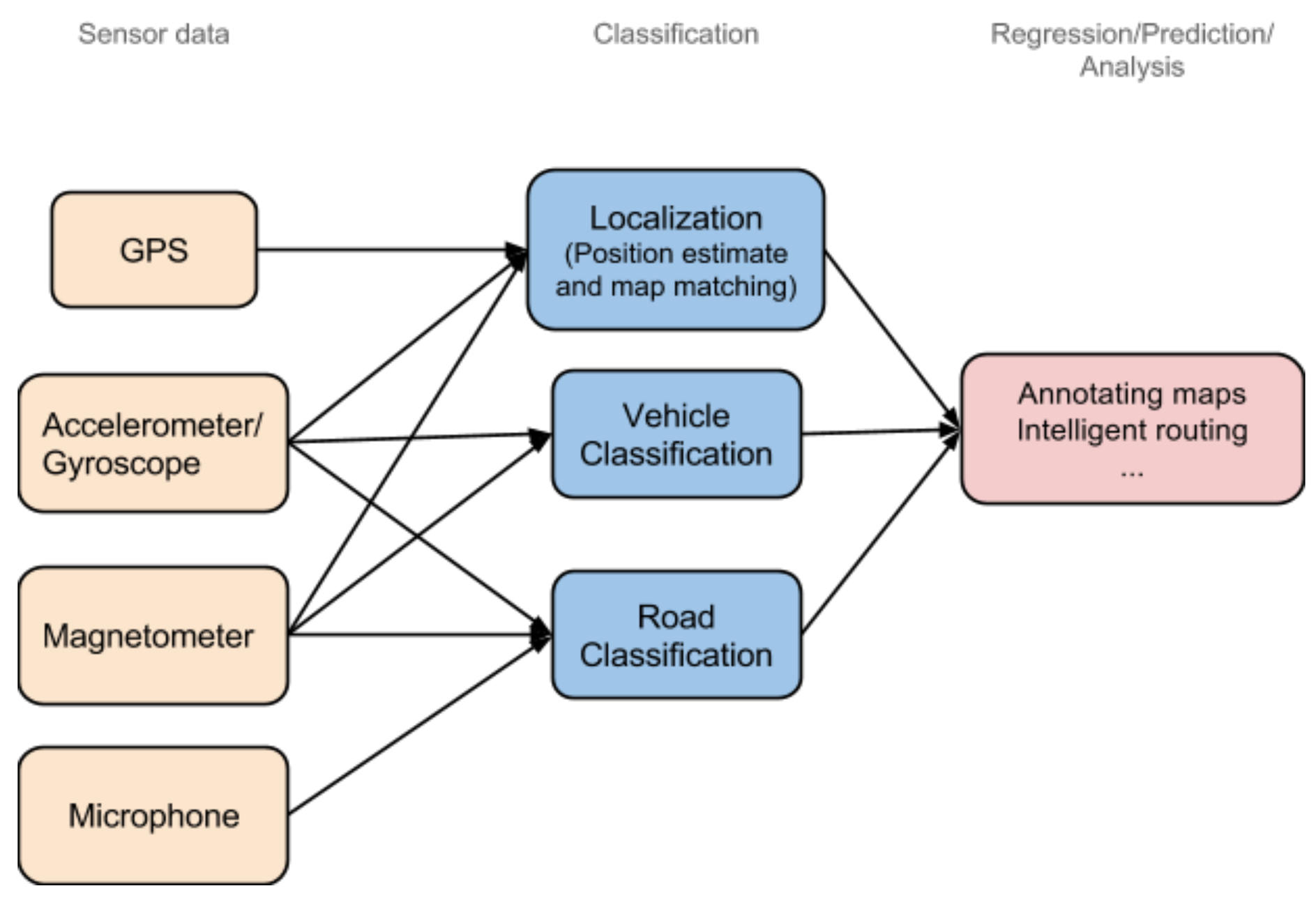
INTRODUCTION

The project aims to analyze and model road traffic conditions. The goal of such analysis is to be able to predict and learn how to give traffic recommendations for better and relaxed travel in India's cities.



LITERATURE REVIEW

Various projects attempt to analyze traffic and road conditions. Some of them are listed below

***Nericell* :** Using GPS, Accelerometer and Microphone on a smartphone, estimate road and traffic conditions. Identify potholes and bumps using simple threshold heuretic on accelerometer data after reorienting with respect to vehicle's axes. Identify honking by checking for more than two energy spikes in frequency domain. Uses triggered sensing to save power.

***Wolverine* :** Uses similar approach as Nericell. Uses magnetometer for reorientation. Use machine learning techniques for identifying potholes/bumps. Initially partition the data using K-means clustering into two classes for labeling. Use SVM classifier to classify after training.

***CloudAtlas* :** Use GPS traces for map building. Initially GPS points are matched to road segments using Viterbi algorithm. The system is modeled as a Hidden Markov Model. Infer whether the trace is matched or not. After repetition of unmatched traces new roads are inferred.

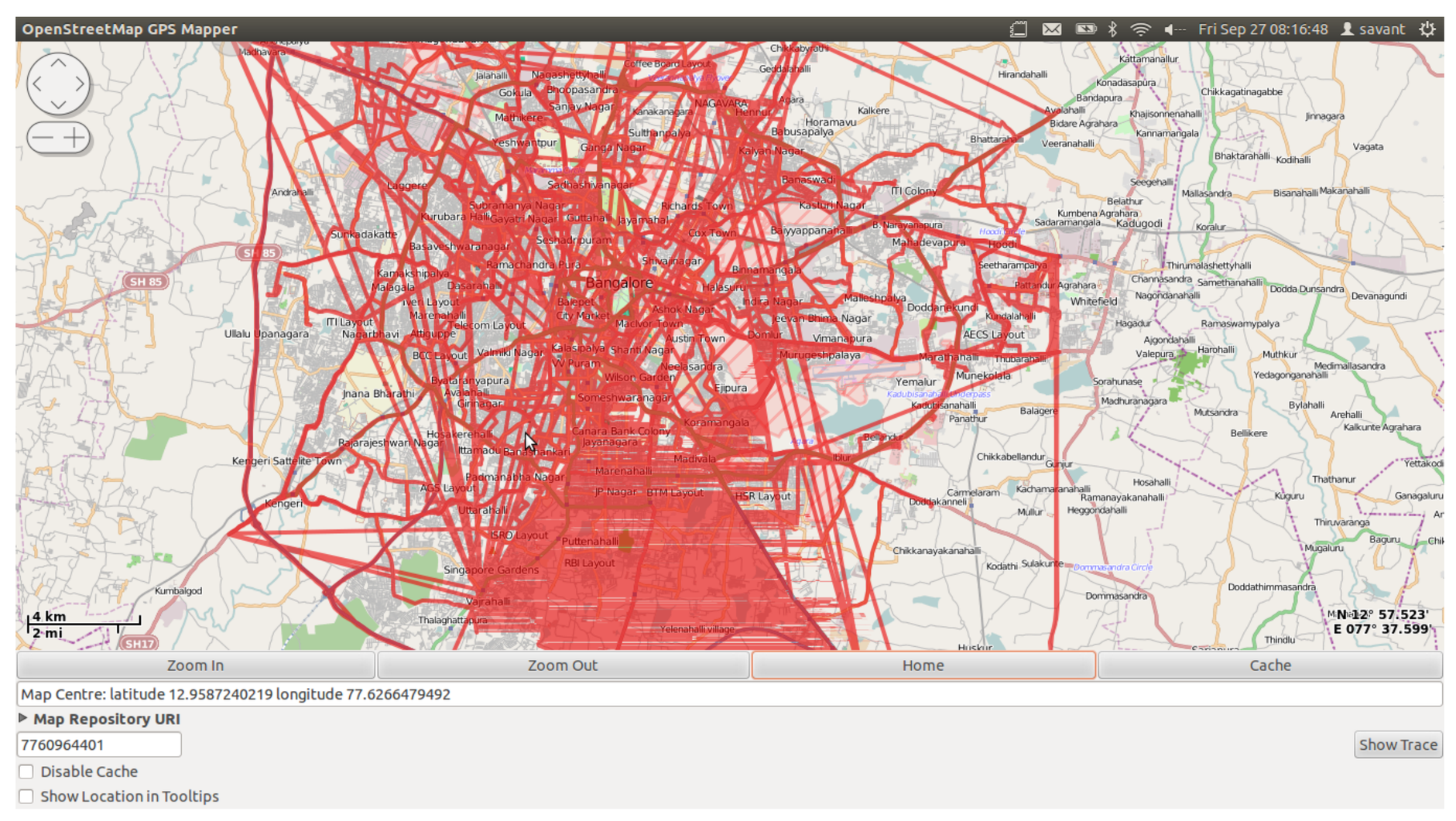
***Driving Coach* :** Obtains sensor data from CAN bus. Extract various features such as minimum, average and maximum of acceleration, velocity, instant fuel consumption and engine rpm, time vehicle has stopped. Classify into fuzzy outputs based on intuitive decision. For a specific set of driving hints, assign fuzzy likelihood values. Defuzzify using center average method and give the maximum likelihood hint.

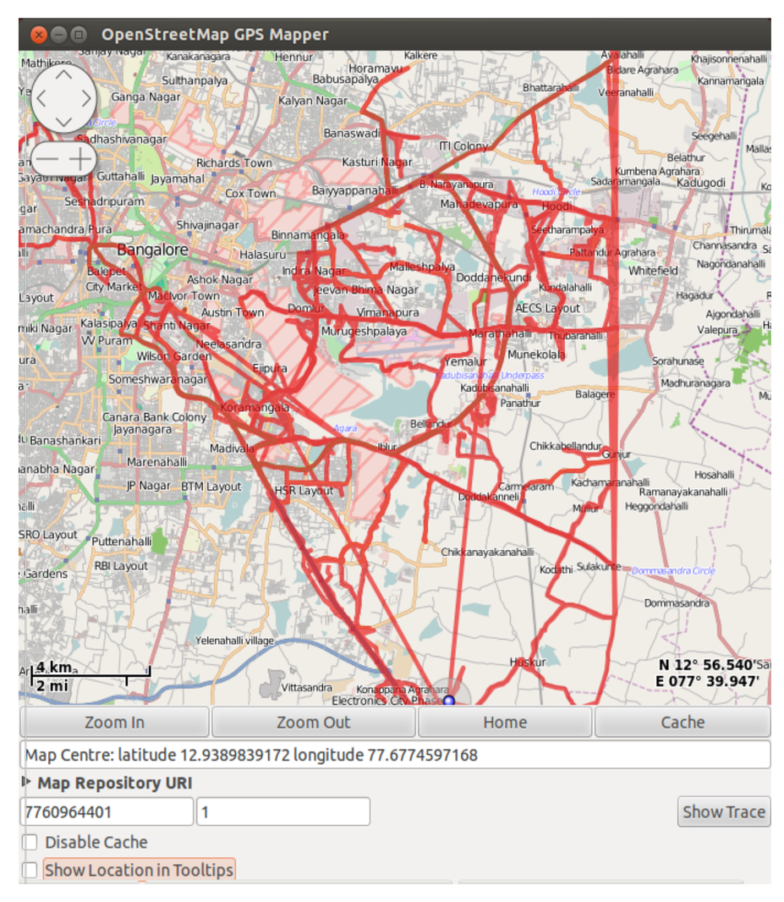
***VTrack* :** Uses sparse GPS and WiFi for delay estimation. Initially does HMM based map matching using Viterbi algorithm wih interpolation, outlier removal and bad zone detecion. Wardriving database is created and used to map WiFi APs to position estimates. Use the travel time estimates to detect hotspots and for real time route planning.

***SignalGuru* :** GLOSA (Green Light Optimal Speed Advisory) using windshield mounted phone camera to estimate traffic signals by performing image processing on video frames. Opportunistic collaboration through WiFi connection. Estimates adaptive signals using SVR (Support Vector Regression) models.

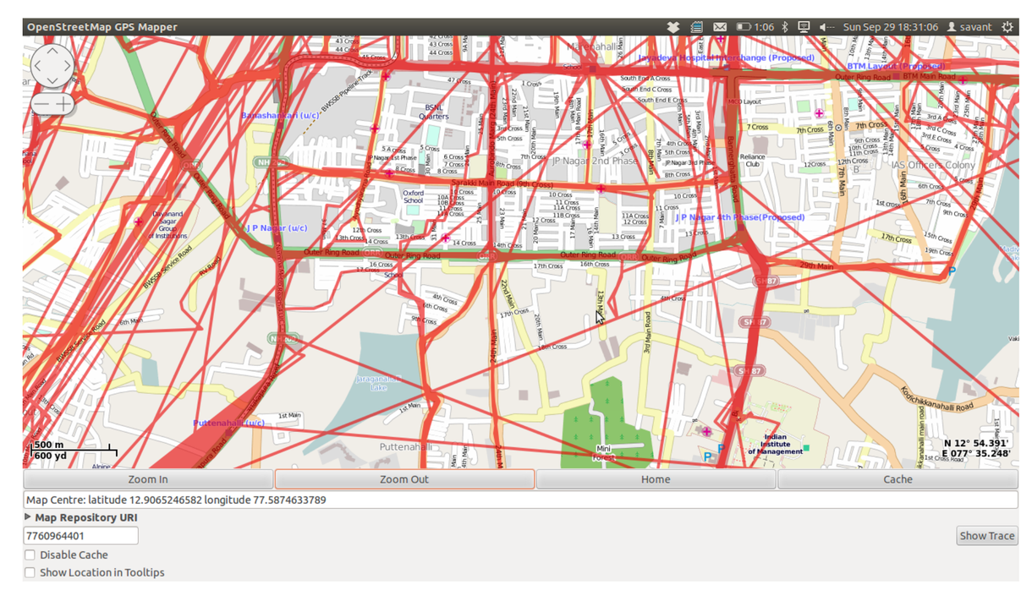
GPS TRACES ANALYSIS

GPS traces data is from about 170 vehicles for a duration of one month. The figure on the right shows paths for all vehicles in one single day. The figure below is are the traces for one particular vehicle on 30 days.





Consider a link on the given road network. Build velocity profile of the link using velocity estimation on the GPS trace data.



For unimodal traffic, time delay vs capacity is :

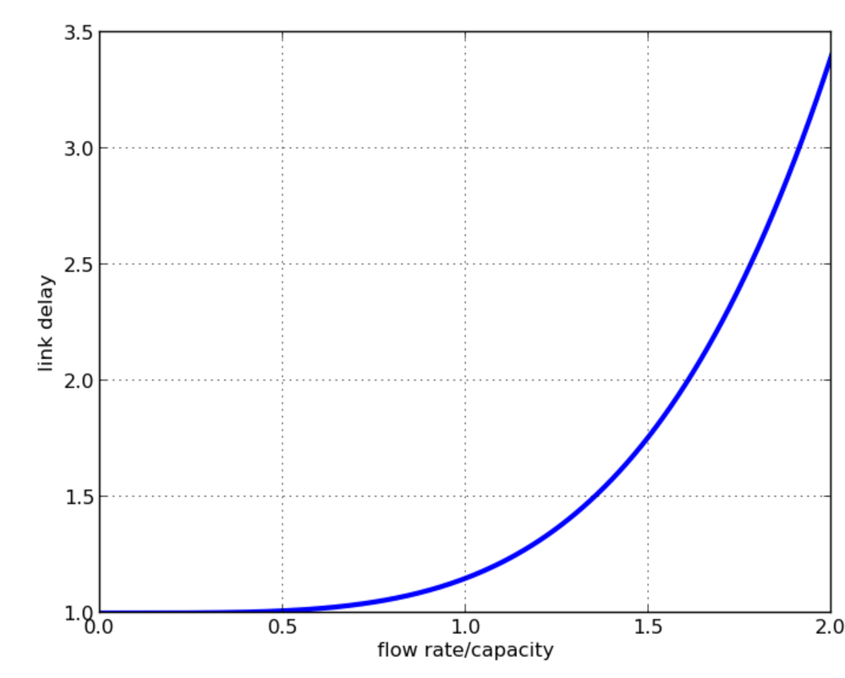
$$t_a(f_a) = t_a^F \left[1 + 0.15 \left(\frac{f_a}{u_a} \right)^4 \right]$$

where

f_a is flow on link a

t_a^F is free flow travel time on link a

u_a is flow capacity of link a



FUTURE WORK

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Figure #1

CHART or PICTURE

Figure #2

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- Visualizing and analyzing GPS trace data : https://github.com/sksavant/traffic-analysis
- xlsx to csv converter : https://github.com/dilshod/xlsx2csv
- GTK widget for map display : https://github.com/nzjrs/osm-gps-map

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