

Information Delivery and Advanced Traffic Information Systems in Istanbul

Kevser Simsek, Rahime Gunay

Abstract—In this paper, we focused primarily on Istanbul data that is gathered by using intelligent transportation systems (ITS), and considered the developments in traffic information delivery and future applications that are being planned for implementation. Since traffic congestion is increasing and travel times are becoming less consistent and less predictable, traffic information delivery has become a critical issue. Considering the fuel consumption and wasted time in traffic, advanced traffic information systems are becoming increasingly valuable which enables travelers to plan their trips more accurately and easily.

Keywords—Data Fusion, Istanbul, ITS, Real Time Information, Traffic Information, Travel Time, Urban Mobility

I. INTRODUCTION

ISTANBUL is one of the world's most outstanding cities and the largest metropolis of Europe with a population around 12.7 million. Like other megacities, Istanbul has needed to meet the challenge of maintaining transportation safety and accessibility as it continues to grow as an important international metropolis.

TABLE I
TRANSPORTATION STATISTICS OF ISTANBUL

| Daily Trip | Total Vehcls | Total Cars | Total Active Vehcls | Daily Addition | Total Road Network | Daily Trips between 2 continents | Private car Av. Travel Time |
|------------|--------------|------------|---------------------|----------------|--------------------|----------------------------------|-----------------------------|
| ~21M | ~2,5M | 1,6M | 1,7-1,8M | ~400V ec. | 25.000K m | ~ 1.1M | 49 min |

The traffic circulation is surveyed and controlled 24 hours in real time via the Traffic Control Centre (TCC) that is an indispensable part of the solutions to the transportation problems of Istanbul. One of the primary responsibilities of TCC is to implement ITS, and an efficient traffic management is only possible with quick, professional, and alternative database.

II. TRAFFIC INFORMATION DELIVERY TYPES

ITS in Istanbul consists of gathered data which is published via TCC's official web site (<http://tkm.ibt.gov.tr/en-EN/index.aspx>), the call center '44 44 154', TV broadcasts, Variable Message Signs (VMS), Lane Control Systems (LCS), the Traffic Intensity Map, a mobile phone application 'IBBCepTrafik' and, in addition to these facilities, real-time traffic information sharing in social networking sites is disseminating rapidly [3].

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III. IBBCepTRAFIK-ISTANBUL METROPOLITAN MUNICIPALITY MOBILE TRAFFIC

IBBCepTrafik is a mobile application which allows people to get traffic flow information from everywhere. It is based on Traffic Intensity Map on the website of TCC. Traffic Intensity Map is a color based digital map that represents current average speeds. It automatically refreshes itself every minute to renew the map with updated data. IBBCepTrafik users can view updated real-time traffic camera images via their mobile phones clearly, and the Traffic Intensity Map enables the drivers to get current traffic congestion information [1].

Drivers choose their starting and destination points and can see the selected route information. In this route information, drivers can get real-time traffic camera images and traffic information such as estimated travel time, weather data, sensor points, and statistics. In addition, TCC broadcasts warnings about negative status which affects current traffic, such as accidents, important incidents or road excavation work over IBBCepTrafik application [1].

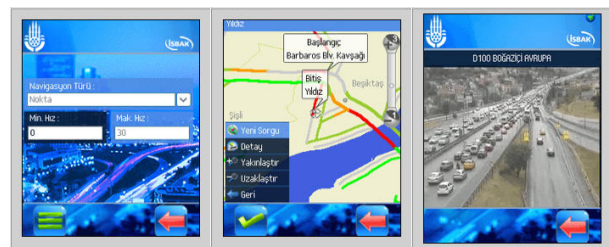


Fig. 1 IBBCepTrafik Screenshots [4].

The number of IBBCepTrafik downloads increased to more than three million, and the average daily user number is more than a hundred thousand for the month November, 2011. The list which based on Apple's user statistics, IBBCepTrafik which is developed by ISBAK Inc. (Istanbul Transportation Telecommunication and Security Technologies Industry & Trade Inc.), which is an affiliated company of Istanbul Metropolitan Municipality (IMM), is the most downloaded free application after Facebook.

IV. FUTURE APPLICATIONS

According to TCC's call center incoming logs, Traffic Intensity Maps and IBBCepTrafik's usage logs, TCC has been able to ascertain that many drivers are planning their travel according to traffic data supplied from these sources. Most drivers can get the traffic information via call center and Traffic Intensity Map on the internet. The call center answers all questions about current traffic status 24/7 and directs the drivers to the least crowded routes. The information which is available through ITS and the Call Center plays an important part in ensuring the best use of Istanbul's available traffic infrastructure. However, the traffic flow information is based on a single data system which allows gathering the data from cameras and sensors [4].

It is a very weak source because of high dud probability. The information could not be good enough for rapidly increasing population of Istanbul. Because of that there is a need to set a system that combines present data sources of traffic in a standard and time lined structure, makes traffic estimation, real time situation analysis and travel time estimation for the route of the user and gives real time traffic information to drivers.

V. ADVANCED TRAFFIC INFORMATION SYSTEM

This project for Istanbul considers the potential for decreasing wasted travel time using past, present and future patterns of mobility. In transportation, reducing travel time will result in benefits such as decreased financial costs and lower carbon emission levels. Travel time will be decreased by planning based on surveying real activities of traffic flow [2]. The System steps are as follows;

- Creating the infrastructure for estimation and instant situation analysis, by combining and keeping different data types from various data sources related to traffic in a common structure (Data cleansing & fusion)[2].
- Estimating duration of travel for route of the driver by using mathematical models and algorithms.(Prediction algorithm development) [2].
- Analyzing the traffic status within a certain scale, building a system which will instantly transfer the data to drivers through various means (web, mobile applications, call center, on-road informative panels etc.)

A. Data Sources

1. Standing data sources

a) *Traffic Measurement (RTMS) Sensors (in present only these data sources are used!)*

These are the data obtained from more than 500 traffic sensors installed on the road, which collect various data (such as vehicle speed, vehicle count and vehicle classification) and deliver them to the center. These data are stored in a central database. These data contain time information (when data is produced) and vehicle number information according to vehicle speed, vehicle classification, occupancy rate of the road and vehicle classes.

b) Traffic Cameras

Roads are constantly monitored by means of 400 traffic cameras installed on the road. These cameras allow incident detection. Traffic density, traffic flow rate, road occupancy rate can be obtained by using image processing methods with some of these cameras. These data are source of data for the system.

c) Road (Asphalt) Situation and Meteorological Sensors

These sensors which are installed on the roads collect data on weather and asphalt status and send these data to the center. Data is stored in a central database.

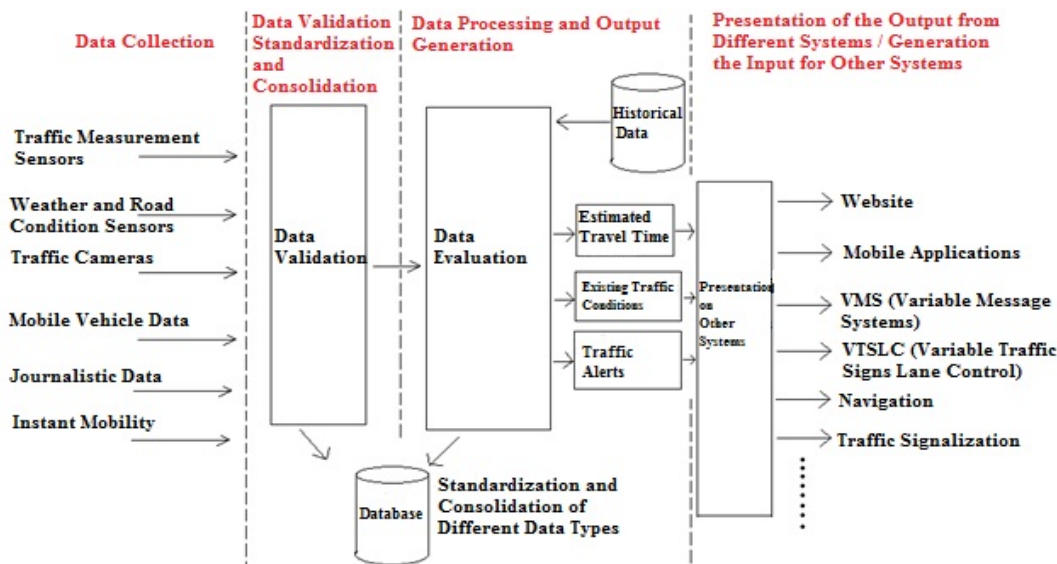


Fig. 2 Advanced Traffic Information System [2]

They include data such as asphalt surface status, asphalt surface temperature, weather forecast (rainfall), rainfall type, temperature, wind direction, wind speed, availability of icing etc.



Fig. 3 Traffic Density Map [3]

d) Mobile Data (Instant Mobility) sources

Producing traffic density information and travel duration estimation, visualizing social traffic networks and patterns by using instant mobility data from GSM operators, checking their development, confirming results produced with other systems.

e) IETT Bus's Floating Car Data (FCD) ISBAK Trucks / Fleet/ Cabs/ etc

These are the data comprised of instant coordinate and speed information, which are obtained from ISBAK ISMOBIL vehicle tracking devices and approximately 5000 buses which are under the control of IETT. Each vehicle provides the center with information such as speed and the point where vehicle is located, at certain intervals. It is also possible to integrate data of different vehicle fleets into the system.

2. Journalistic Data

a. Accidents

b. Weather prediction reports

c. Road excavation reports

It is the data produced from call center of IMM Traffic control center, of which number is 44 44 154. Purpose of the call center is notifying people travelling on the road with regard to route determination and alternative routes where traffic density is low, when it is needed by the drivers. Data source of the system is calls of the call center concerning accidents, stopped vehicles, intense traffic etc.

B. Data Processing

It may be necessary to use different processing methods for different data sources. 'Raw' data from data sources will be processed and turned into 'clean' data [2].

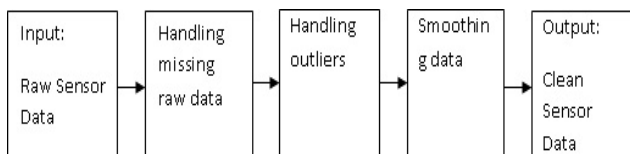


Fig. 4 Process of Advanced Traffic Information System [2]

C. Prediction Algorithm

1. Inputs

- Combined data (cleansed & fused data)
- Historical data
- Weather and road situation
- Journalistic Data
- Prediction time (15, 30, 45, or 60 mnt.)

2. Output

- Estimated Road speed
- Estimated travel time

VI. INTENDED OUTCOMES

Target group of the project outcome is everybody who wants to receive information on traffic situation.

- The data, which is obtained from different data sources such as traffic measurement sensors, weather and road condition sensors, mobile vehicle data, journalistic data and etc., will be used for traffic estimation by combining all gathered data in a mutual format. It allows user to get the information in a single data source as standard.
- It will be possible to store traffic data historically. Traffic data will be able to provide source for researches on different matters.
- Any person will be able to learn in how much time he/she will arrive the point that he/she wants to go on any route.
- System will be capable of producing alternative routes for the person, upon delivery of travel duration and traffic density data with a certain scale. Alternatively, the system will be the data source of systems that will produce alternative routes.
- The project will generate a more easily administrated traffic control system in Istanbul.
- It will be possible to use project outputs as input for different traffic control systems in place (signalization, variable message systems, line control system etc.)
- It will be possible to transfer project outputs to people via different means (current web, mobile applications, radio, television etc.)

VII. CONCLUSION

An automobile which has 163 gr/km CO₂ emission and takes averagely 15000km per year approximately gives 2,5 ton CO₂ emission to the environment. By decreasing travel time only five minutes per day greenhouse gas emission will be decreased significantly, and this resulted in an estimated fuel savings benefit ranging from between 32,600 to 59,000 liters/year. In this project travel demand is analyzed separately as travel time and activity time.

The project explores how travel time can be used productively as activity time, and what enhancements to time use will be added. Such a project may have major implications for modal distribution of travel, future levels of mobility, updating of current transportation methodology, and for the analysis of travelling.

Once real time traveler information taken from social networking sites and call center reports are included, this project will have more accurate travel time prediction results to route travelers, and enable them to save the most valuable thing, time.

Estimated travel times, calculated on the basis of road sensor data, indicates that although alternative routes are often longer in distance, drivers are reaching their destinations in less time. Consequently, a smaller amount of air pollution is generated for the same trip. Another benefit is presumably that drivers who spend less time stuck in traffic jams experience less stress from traveling in Istanbul.

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