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Design and Development of NOVEL System for Traffic Congestion

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Abstract **Traffic congestion occurs when slow moving vehicles congregate, causing increased travel time and fuel consumption. Observation and predictive analysis of historical trends in traffic data will provide opportunities to mitigate the adverse effects of traffic congestion by improving the road infrastructure, subways, and other forms of public transportation. The most important information that can be captured from public transportation systems is origin-destination information.This product and service will be of highest interest to civil and traffic engineers working for (or with) municipal and state transportation departments.The primary objective of this project is to collect origin-destination information from busses, and format it into a useable format for use by the customers.The topics covered in this paper are traffic congestion, proposed solution, competition survey, product analysis.**

Keywords**—Origin-Destination,Traffic Congestion.**

I. INTRODUCTION

Urban planners work with architects, civil and traffic engineers, and public administration officials to design and construct urban landscapes, including air, water, and the infrastructure such as transportation and distribution networks. Accurate, timely, and comprehensive data are essential inputs to the planning process.Analyzing traffic patterns, where commuters enter and exit the infrastructure (origin and destination points), provides the civil and traffic engineers with the data needed to address current issues, such as congestion, as well as predict future infrastructure needs. The TCMS(Traffic Congestion Monitoring System) product facilitates commuter data collection on the public bus system. This can be easily be ported to other public systems such as trains and subways.

A. Idea Description

Traffic congestion is defined as a condition on road networks that occurs as use increases. Typical effects are slower speeds, longer commute times, increased vehicular queuing, and hours of lost productivity. Fuel consumption increases along with carbon emissions, creating additional health hazards. Progress of emergency vehicles may also be retarded. Statistical analysis of the CensusIndia[1], World Bank[4] shows significant increases in commuters and vehicles, heightening the need for infrastructure and public transportation improvements. India was home to 40 million passenger vehicles in 2009. More than 3.7 million automotive vehicles were produced in India in 2010 (an increase of 33.9%), while bottlenecks contribute approximately 40% of traffic congestion. According to the Society of Indian Automobile Manufacturers, annual vehicle sales are projected to increase to 4 million by 2015. Observation and predictive analysis of historical trends in traffic data will provide opportunities to mitigate the adverse effects of traffic congestion by improving the road infrastructure (roads, bridges, traffic signals, etc.), subways, and other forms of public transportation. Current systems used to obtain the necessary data vary widely in features and functions. The TCMS sensor prototype will be compared against these to determine the most efficient way to move forward.

B. Objectives and Scope

There is an increased need for new and / or improved methods for capturing and analyzing commuter data as current methods are time-consuming and incomplete.

- A non-intrusive data collection product or service needs to be selected to collect the traffic data.
- This data can then be presented, in a useable format, for analysis by the engineers to identify congested traffic areas.

- Engineers will then be able to make informed decisions to determine how to resolve these congestions. These determinations are outside the scope of this project and product.

C. Potential Additional Applications

The sensors have great potential in private mass transportation and other forms of public transportation. Information captured by these sensors can be used for security purposes, population control, and for pedestrian traffic (theme parks, museums, etc.) but this would require significant redesign work, i.e. from short-range, moving vehicle to long-range, stationary position.

II. LITERATURE SURVEY

A. Market Survey

This product and service will be of highest interest to civil and traffic engineers working for (or with) municipal and state transportation departments. Through the analysis and interpretation of commuter information they will be able to mitigate traffic congestion – temporarily, by rerouting public services, or permanently, by improving the infrastructure of highways, bridges, subways, and other forms of public transport.

The population of India is estimated at 1,267,401,849 as of July 1 2014. The number of automobiles produced in India rose from 6.3 million (6.3 million) in 2002–03 to 11 million (11.2 million) in 2008–09.[2] Delhi alone adds 1400 cars to its roads every day. Over the last decade, the number of vehicles in Delhi has jumped by a phenomenal 97 percent [3]. The statistics remains the same throughout the country in every metro and urban cities.

B. Customer characteristics

Public transportation departments have the sole responsibility of enhancing a country's transport system and infrastructure; one way this can be done is by identifying trends in commuter data. Civil and traffic engineers are faced with the tedious task of capturing, analyzing and recommending changes for these systems based on commuter data. The methods used for capturing commuter data change relative to the population size, resulting in inconsistent data sets. Accurate, timely, and comprehensive data is crucial if civil and traffic engineers are to plan, prevent, and predict effectively.

C. Competition and Trends

TCMS sensors utilize commuters' wireless devices in order to collect this data for use by civil and traffic engineers. Working with TCMS can help them make decisions that will reduce traffic congestion.

TomTom purchases the raw data and provides subscription-based data analysis services. There is limited customization available.

Google purchases the raw data, which they use for their own applications such as Google Maps. They do not provide any data analysis to third parties.

INRIX is the world leader in providing system-wide information that analyzes data from traditional road sensor networks with up-to-the-minute data from consumer and fleet vehicles, mobile devices, and incidents. With millions of additional GPS points, INRIX offers public agencies access to the most comprehensive coverage and analysis available.

D. Critical success factors

The product must provide a high level of data accuracy including origin and destination traffic patterns as well as traffic and passenger volume. The initial investment and ongoing service requirements must be cost effective and comparable with competitors.

Compliance with health and safety regulations (radiation, etc.) are essential. There needs to be awareness of, and adherence to patent and legal constraints.

III. PROPOSED WORK

A. Solution Summary

Team TCMS proposes the design of a system for collecting traffic data by leveraging mobile devices. Recall that in order to successfully obtain OD data, a method of uniquely identifying passengers is needed. The team does this by extracting MAC addresses from wireless devices. This model fits our design goals by being an easy-to-deploy, non-intrusive method of logging historical passenger data. In theory, the device would be capable of detecting commuters traveling by car, bus, train, and virtually any mode of transportation. The proposed system has three main components: (1) an Intel Galileo based sensor that collects MAC addresses, (2) an Intel Atom based server for data processing, and (3) a web application to help researchers and civil engineers aggregate and visualize the data. The sensor would be used throughout the day to capture probe requests and store the raw data into log files. These logs would be transferred to a server for post processing to separate the actual passengers of the bus from the many outliers that may also be detected. The passenger data is stored in a database that can be queried using a web application to allow the user to easily visualize the data.

B. Design Details

Figure.1 outlines the general sequence of events that our proposed solution will execute. A GPS module will be used to determine whether a bus is at a bus stop. Once at the stop the wifi sensor on the bus will scan for MAC addresses. At the end of the day, when the bus arrives at the bus station, the collected data will be transmitted to a server for filtering and analysis. This data will then be accessible to civil and traffic engineers

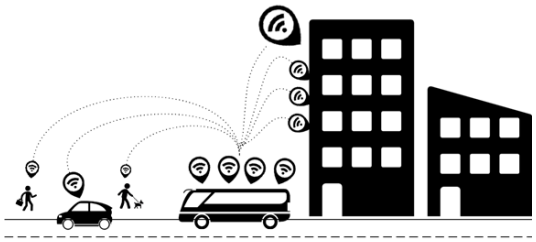

Figure 1. High level block diagram.

C. Hardware Block Diagram

The diagram shown in Figure 2 provides an overview of the hardware needed for the proposed solution.

The DE2i-150 board is equipped with an Intel Atom processor and will be used as a server that will be responsible for analyzing and displaying data. The Intel Galileo will be used as the main sensor. It is an Intel Quark based SoC that is capable of hosting an embedded Linux distribution. It has a mini-PCIe slot to hold a wireless card which is capable of scanning for MAC addresses. A Real-Time Clock (RTC) is used to maintain an accurate timestamp and a GPS is used to detect when the bus is at a stop or when the bus is at the bus station. When at the station the proposed device will upload the collected data to a server.

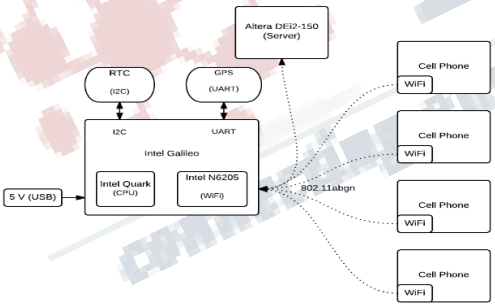

Figure 2. Hardware block diagram.

III. PRODUCT ANAYLSIS

Table 1: Product Comparisons.

Factors	TCMS	Tom Tom	Googlea	INRIX
Collection Method	Wi-Fi	INRIX	INRIX	Multiple
OS Dependency	None	None	None	None
Accuracy of Analysis	Medium	Very High	N/A	Very High
Anonymous Data Collection	Yes	Yes	No	Yes
Proprietary Control of Raw Data	Yes	No	No	No
User Triggered	Passive	N/A	Passive	Passive
Hardware and Software	Yes	No	No	No
Service Based	Yes	Yes	N/A	Yes
Origin / Destination Analysis	Yes	No	N/A	Yes
Global Population Mapping	No	No	N/A	Yes
Real-Time Traffic Service	No	Yes	Yes	Yes
Traffic Incidents	No	No	Not Real-Time	Yes

IV. SWOT ANALYSIS

Table 2: SWOT Analysis

Strengths	Weaknesses
a. Proprietary Control of Raw Data b. Emerging Company c. Web Presence	a. Collection method b. Accuracy of Analysis c. Hardware and Software Required
Opportunities	**Threats**
a. Capability for Enhancing GPS Module b. Much Room for Innovation c. Pedestrian Tracking	a. Accuracy of Analysis b. Superior Features from Competitors

A. *Competitive positioning*

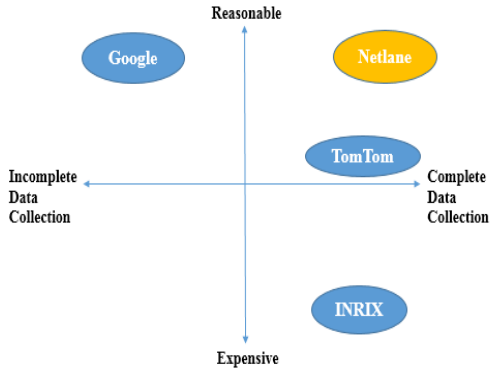

Figure 3. Competitive positioning diagram.

V. CONCLUSION

Overall our design, a wireless sensor that can capture origin-destination information from public transportation systems. Te sensor hardware is teamed with a server that filters the data and provides it to the civil engineers in a format, which they can use to improve public transportation systems. This sensor is cost effective. Sensors can be placed along roadways and highways to determine OD data from private vehicles. They can also be placed inside trains, subways and parks to capture foot traffic throughout a city. Each of these scenarios require additional features that currently remain unimplemented such as an internet data connection via wired Ethernet, Wi-Fi, or cellular. Infrared or laser sensors can help to improve the volume data collected by TCMS sensors.

REFERENCES

[1] Population of INDIA
http://www.worldometers.info/world-population/population- by-country/

[2] Commuter vehicle Statistics
"Production Trend". Official webpage of the Society of Indian Automobile Manufacturers. Retrieved 13 April 2009.

[3] Commuter vehicle Statistics- Delhi
Gentleman, Amelia (7 November 2007). "New Delhi Air Quality Is Worsening, Group Says". New York Times. Retrieved 5 April 2010.

[4] Traffic Congestion INDIAN Metro Cities
http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/EXTSARREGTOPTRANSPORT/0,,contentMDK:20703625~menuPK:868822~pagePK:34004173~piPK:34003707~theSitePK:579598,00.html