GT-FAST- An Intelligent Commuter Information System

Sree Sen S S
B.Tech Student
Department of IT, YCET
Kollam-10, Kerala, India

Nishad H
B.Tech Student
Department of IT, YCET
Kollam-10, Kerala, India

Femina Rahim
B.Tech Student
Department of IT, YCET
Kollam-10, Kerala, India

Prof. Nijil Raj. N
Associate Professor
Department of CSE & IT, YCET
Kollam-10, Kerala, India

***Abstract*—City efficiency largely depends upon the effectiveness of its transport systems, that is, efficiency with which people and goods are moved throughout the city. Poor transport systems stifle economic growth and development, and the net effect may be a loss of competitiveness in both domestic as well as international markets. Though India is developing country Indian cities have higher vehicle ownership rate, number of vehicles per capita, we suffer from worse congestion, delay, pollution and accidents than cities in the industrialized world. Road traffic congestion is a recurring problem worldwide. The challenges that people face nowadays are, if a person wants a public transportation system for traveling, he must find a vehicle himself ie, he had to go to a taxi stand or an auto rickshaw stand. Availability of vehicle is not sure at all junctions. The Driver may not be aware of the traffic blocks in the route. To solve all such challenges we are proposing a new system named GT-FAST(Get There Fast), which is intended to solve the difficulty in getting vehicle service for transportation and provide advanced traffic information to the commuters thus reducing transportation issues. GT-FAST provides a way to efficiently use services of all public vehicles to everyone with equal priority. It works with GPS along with GSM and a real time Server. They all are combined together to form GT-FAST system.**

Keywords– GT-FAST, GPS, GSM

I. INTRODUCTION

India, the second most populous country in the world and a fast growing economy, is seeing terrible road congestion problems in its cities. Building infrastructure, levying proper taxes to curb private vehicle growth and improving public transport facilities are long-term solutions to this problem. These permanent solution approaches need government intervention. The Government of India has committed Rs.234,000 crores in the urban infrastructure sector [1]. Bus Rapid Transit (BRT), metro rails and mono rails are being built in different cities to encourage the use of public transport. But still there is a steep growth of private vehicles [2]. Some cities like Bengaluru, Pune, Hyderabad and Delhi-NCR, with their sudden growths in the IT sector, also have a steep growth in population, further increasing transportation needs. Meeting such growth with infrastructure growth is seemingly infeasible, primarily because of space and cost constraints.

Intelligent management of traffic flows and making commuters more informed about traffic and road status, can reduce the negative impact of congestion, though cannot solve it altogether. This is the idea behind GT-Fast.

Intelligent Transportation System (ITS) in India, however, cannot be a mere replication of deployed and tested ITS in the developed countries [3]. The non-lane based disorderly traffic with high heterogeneity of vehicles, need the existing techniques to be adapted to the Indian scenario, before they can be used. Thus ITS in the Indian context needs significant R&D efforts. ITS is an interdisciplinary research area.

II. RELATED WORK

Many related works have been done related to tracking vehicles using GPS and GSM providing location of the vehicles. Some are meant for detecting vehicle thefts, recently different Taxi agencies have done projects providing service of their vehicle to the users location when requesting through message or calling.

A. Literature Review

Transportation has long been recognized as having an impact on economic development. Factors such as levels of investment in transportation have been shown to have a positive impact on economic growth [4] [5]. In the developing world, the availability of safe and reliable transportation can have even broader implications. Not only does access to transport improve access to markets and mobility of workers, but it is also critical to the timely and affordable delivery of services such as health and education, can serve to empower vulnerable groups by increasing their independence, and is key for maintaining social networks [6] [7]. Along with providing access to transportation, it is also important to provide potential users with information about its availability.

In the developed world, users can often access information about most bus and train schedules easily via printed schedules or web pages maintained by centrally funded transportation authorities. In some cases, users can view real time updates on the current location and expected arrival time of their bus or train via web or phone [8] [9]. However, when a community lacks the infrastructure to provide such information resources, potential users can find themselves unable to take advantage of whatever (limited) transportation resources are available.

III. EXISTING PROBLEM

India is developing country Indian cities have higher vehicle ownership rate, number of vehicles per capita, we suffer from worse congestion, delay in getting vehicle to travel and accidents than cities in the industrialized world. Road traffic congestion is a recurring problem worldwide. The challenges that people face nowadays are, If a person wants a public transportation system for traveling , he must find a vehicle himself ie, he had to go to a taxi stand or an auto rickshaw stand, availability of vehicle is not sure at all junctions, the driver may not be aware of the traffic blocks in the route, travellers may not be aware of the name of their current location. Sign boards in the roads may not be visible to the drivers. To solve all such challenges we are proposing a new system named GT-FAST(Get There Fast)

IV. METHODOLOGY

We designed a system with the goal of improving access to transit information for potential vehicle riders at a minimum of cost to users. For our solution, we chose three existing technologies. The existing technologies we used were SMS, GPS, and GSM, all described below.

A. Short Message Service (SMS)

SMS, also known as text messaging, is a protocol to exchange short messages between mobile phones. Our system uses SMS as its primary communication mechanism. We chose SMS for several reasons. Text messages are perceived as relatively cheap, costing anywhere from IND 0.05 to 1 to send a message, and for many plans it is free to receive messages. Good urban and rural cell coverage is becoming the case in much of the developing world. SMS-based solutions have proven robust, flexible, and valuable to multiple communities [10] [11]. Text messages, as opposed to richer mechanisms for distributing information, such as web pages, can be supported by cheap and ubiquitous phones; additionally, because of the way the mobile phone integrates into how people already get information in their daily lives, it is a better solution space than Internet-based resources.

B. Global Positioning System (GPS)

GPS satellites transmit microwave signals to GPS receivers that use data from the signal to determine the location of the receiver. Our system relies on information provided by GPS satellites to determine the current location of all vehicles participating in the system. GPS was chosen over other methods of location determination, such as GSM triangulation [12], for its high level of accuracy within 8-10 meters, and its appropriateness for outdoor usage, particularly in rural areas or urban areas with few tall buildings and mostly wide streets. Although GPS units continue to decrease in price, they currently are only included as part of high end cell phones. Thus, our system attempts to minimize the number of GPS units required by allowing vehicle riders to leverage GPS units in vehicles to tag locations they are interested in querying about in the future. In this way, we are leveraging an expensive piece of technology that is rare in the community (GPS enabled phones are not a significant part of the market in most parts of the world) in order to make its capabilities serve the needs of a larger group. In the GT-FAST system, multiple individuals can make use of the capabilities of GPS technology despite individuals not owning their own device.

C. Global System for Mobile (GSM)

GSM (Global System for Mobile Communications, originally Groupe Special Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second-generation (2G) digital cellular networks used by mobile phones. GSM communications is the most popular mobile phone network standard. The GSM used is SIM 900A. It receives the information which are to be displayed through the LCD panel inside the vehicle. It also transmits the latitude and longitude coordinates to the server.

V. PROPOSED SOLUTION

The overall architecture of the GT-FAST project, shown below in Figure 1, incorporates the three existing technologies mentioned above with two new components. These engineered components are: An advanced traveller information LCD display panel and a back end server that aggregates the location of the vehicle, runs a nearest vehicle finding algorithm, and provides the querying service to riders.

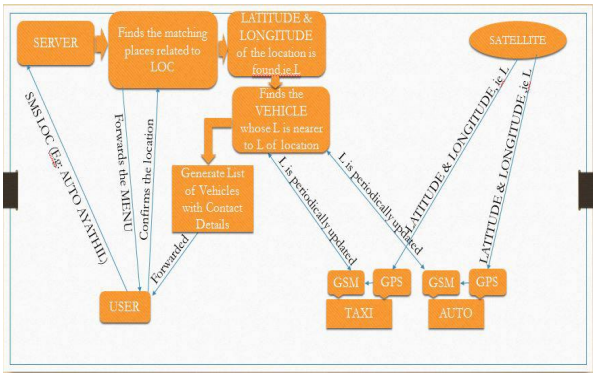

Fig. 1. Basic Architecture

The goal of the GT-FAST system is to track vehicles GPS coordinates and to provide users an SMS messaging system that will give information of the nearest vehicle in their location for easy transportation. The GT-FAST utilizes GPS

satellites to locate the vehicles, the GT-FAST hardware includes a GPS device and a GSM modem integrated into a single package that just requires a local SIM card. The GSM modem send SMS messages with the GPS data to the server, taking advantage of the widespread GSM cellular phone networks. On the back end, the central server continually collects the GPS location data from all vehicles and stores it in a database. The server consists of a computer connected to a mobile phone capable of sending SMS messages and that serves a gateway to the SMS services. Potential vehicle riders can use their cell phones to send SMS queries to the GT-FAST server and receive transit information in response.

The GT-FAST system is not designed to target Internet users specifically, but rather, gauges general trends among overall population and provide access for ordinary peoples to use our services. Each vehicle driver participating in the vehicle transportation network will need to have a GT-FAST module placed on their vehicle with them at all times to allow riders to receive updates on the traffic notifications regarding the traffic blocks, accidents, current location, accident prone areas etc. At least one server, connected to a cell phone, also needs to be running at all times to receive location update messages from GT-FAST device and to accept and respond to queries from users. That server can be located anywhere in the country with cell coverage.

A. GT-FAST Module

1) GT-Fast Driver Interface(LCD Display)

The GT-FAST module was designed to provide information to the vehicle driver as well as the passengers. The information including traffic blocks, current location etc. are displayed on a LCD panel in the vehicle and stored locally on the module to be appended to each location update message sent to the server. Advanced version of the display can be used according to different type of vehicle, like buses large displays can be used in order to be visible for the passengers

2) GT-FAST Module Internals

The GPS system must be able to determine its location (via GPS satellites) and send a time stamped SMS to the server. For our prototype device, we chose the GPS module. We chose to implement the vehicle system with this very compact module because it provides a low cost solution with the additional convenience of combining GPS and GSM on one board (see Figure 2). MAX232 is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontroller with other components. A PIC 18F452 microcontroller is used to coordinate the communication between the GPS, GSM, and the LCD. The module continuously obtains its GPS location information from GPS satellites without any action by the driver and reports this information along with its vehicle number to the server via an SMS message.

B. GT-FAST System Server

The primary purpose of the server is to accept SMS messages coming from vehicle and users to process them accordingly. System requirements are intentionally minimal: a laptop or desktop computer running a Java virtual machine and a MySQL database, connected to a phone capable of receiving SMS messages. Lower system requirements allow the server to run using older and less expensive hardware.

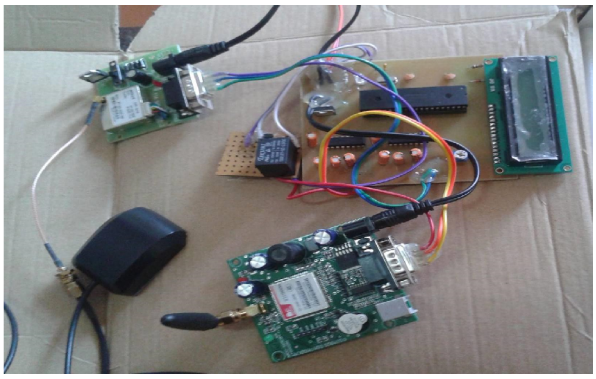

Fig. 2. GT-FAST vehicle module

The server need to be connected to the Internet in order to convert the latitude and longitude received from the vehicle to its corresponding location name. Our prototype server was implemented using the software tools like Netbeans, MySQL as the database, notifications, remote code execution and rapid application development to be executed over SMS or via internet for the smartphone users.

The server is responsible for handling the following types of requests which arrive via SMS messages.

1) Location Update Messages from GT-FAST Vehicle Module

Messages sent from the GT-FAST module to the server have the following format:

< Vehiclenumber >#< latitude, longitude >

Vehicle number is the unique identifier assigned to each individual vehicle that is equipped with GT-FAST module. The latitude and longitude retrieved from the GPS is transmitted to the server via GSM. The latitude and longitude is converted to the location name. The server records this information in a database for use in responding to user queries.

2) Nearest Vehicle finding Queries from Users through SMS

Information gathered about the current location of vehicles in the system could be used to answer a variety of queries. The server continuously receives and replies to SMS queries from users. The users can simply text to GT-FAST server

telephone number, and the server responds by sending an SMS back to the users phone number.

The most basic example is to ask the server to predict the nearest vehicles like Auto rickshaws, Taxi Cars and other public transportation vehicles at the users location in the following format:

< *Vehicletype* > *SPACE* < *Location* >

The server replies to the user with a SMS predicting a list of 5 nearby vehicles:

< *Vehiclenumber, Phonenumber* >

< *Vehiclenumber, Phonenumber* >

.

.

< *Vehiclenumber, Phonenumber* >

3) Nearest Vehicle finding request through GT-FAST Smartphone Application and Geo-coding Requests

Fig. 3. GT-FAST Smartphone Application Interface

The GT-FAST application is compatible with all Smartphones. The user can call the nearby vehicle by just pressing the button. The GPS with in the phone is used to obtain the latitude and longitude coordinates. The latitude and longitude is converted to the location name. These can potentially be associated with locations of vehicles in the servers database. This application works only if internet connection is available in phone.

4) Advanced traveller information Guidance through LCD Displays

All the Traffic blocks information obtained from the traffic authorities is propagated to the corresponding congestion area via the LCD displays embedded along with GT-FAST module in the vehicles. The vehicle location name updates, Insurance validity notification messages can be send to the vehicles via LCD displays like Telematics display inside the vehicle. It has been designed to be easily expanded to handle more complex activities such as route planning or registration for notification of bus location updates, special Guidance packages for Tourists, Displaying all the Road Sign boards, Advertisements and thus introducing more advanced visual displays.

Fig. 4. Telematics Display inside vehicle

VI. Prototype Deployment Results

We have implemented prototype versions of the GT-FAST module hardware and the server software. In this section, we describe some preliminary data collected on the technical performance of the system. We deployed a GT-FAST module on several vehicles in the Kollam District area. The GT-FAST module sent SMS messages to the server containing its GPS coordinates at an interval of one message every 10 seconds. The amount of time required for SMS messages to travel through the network, both those giving location updates and those from user interaction, also affects the accuracy. We examine these factors below.

A. Message Latency

1) GT-FAST Module to Server Latency

The accuracy of a particular prediction depends on both the accuracy on receiving a recent, and thus accurate, location update from the vehicle whose status is currently being queried. Ideally, the server would have instantaneous information about the exact location of a moving vehicle at the point it receives a user query to find the nearest vehicle at user location. In practice, the server must base its prediction on the last location update message received from that vehicle. Both the configured GSM frequency of sending

updates from GT-FAST module and any delay in that message getting from the module to the server affects accuracy of information about the current vehicle location. Latency of SMS messages can be affected by a variety of factors, such as cell phone network congestion, signal coverage for the GSM on GT-FAST module or the server, or the need for messages to cross networks. We recommend that the GSM in GT-FAST module and the server be on the same cell phone network, as they were in our implementation, to minimize this delay.

2) User Query Latency

Queries return information to users with a list of nearest vehicle in a sorted order. The usefulness of this information depends upon both its accuracy and how quickly it is returned to the user.

Factors affecting query processing latency include: server load, cell phone network load, and system limitations on rate of SMS message sends. Based on our measurements of message latency, we would predict the round trip time for the user to receive a response to their query to be the latency of two SMS messages (assuming time spent at the server is negligible), or approximately 20 seconds. Considering that the typical usage scenario would return predictions on vehicles several minutes away, we consider this latency to be acceptable.

VII. Conclusion

Though this project was initially conceived with a strict organization structure, in mind, the highly flexible design has made it a product that can be used by any vehicles. Designed and built using proven tools and technologies, this project is highly scalable in terms of functionality and performance. It can also be configured to support any number of vehicles. Any number of functions that enhance the user experience or increase usefulness can be quickly added to this project. This system can efficiently control traffic congestion and provide advanced traffic information service.

ACKNOWLEDGMENT

At first I would like to express my heartfelt gratitude to our guide Prof.Nijil Raj.N, Head of The department, computer science and information technology , Younus College of Engineering and Technology, for providing every facility, constant supervision. It gives us immense pleasure to acknowledge a debt of gratitude to our principal Dr.Abdul Mageed, Younus College of Engineering and Technology. Thanks to all the teaching and non-teaching staff of Younus College of Engineering and Technology, for their support and also to my Class-mates for their valuable Co-operation.

REFERENCES

[1] http://www.technologyreview.in/ computing/37647/.

[2] http://asiancorrespondent.com/39640/isindia-waiting-for-its-longest-trafficjam/.

[3] Rijurekha Sen, Bhaskaran Raman,"Intelligent Transport Systems for Indian Cities",Department of Computer Science and Engineering Indian Institute of Technology, Bombay

[4] G. Weisbrod, Models to predict the economic development impact of transportation projects: historical experience and new applications, The Annals of Regional Science, Volume 42, Number 3 / September, 2008.

[5] S. Dmurger, Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China? Journal of Comparative Economics, Volume 29, Issue 1, March 2001, pp. 95-117.

[6] D. Parikesit and K. Czuczman, Transport, the missing link? A catalyst for achieving the MDGs, id21insights, #63, July 2006, http://www.id21.org/insights/insights63/insights63.pdf

[7] A. Bradbury, Transport, mobility and social capital in developing countries, Proc. of the Institution of Civil Engineers, Engineering Sustainability 159, June 2006 Issue ES2, pp. 79-86.

[8] NextBus, Last accessed: 22 Sept. 2008. http://www.nextbus.com/

[9] MyBus, Last accessed: 22 Sept. 2008. http://mybus.org/

[10] J. Donner, Research Approaches to Mobile Use in the Developing World: A Review of the Literature. The Information Society 24(3), 2008.

[11] MSR India SMS Toolkit, Last accessed: 22 Sept. 2008. http://www.code-plex.com/smstoolkit

[12] P. Javid and T. Parikh, Augmenting Rural Supply Chains with a Location-Enhanced Mobile Information System, in Information and Communication Technologies for Development 2006, May 25-26, 2006, Berkeley, CA.