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Promoting Transportation Information System Using GPS and SMS System

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ABSTRACT

This work consists of two main components:(a) a longitudinal ethnographic study in Village that demonstrates the importance of transportation resources in the developing world and how to plan for an appropriate ICT solution, and (b) the results of a proof-of-concept system engineered to create a bottom-up, transportation information infrastructure using only GPS and SMS. Transportation is a very important shared resource; enabling efficient and effective use of such resources aids overall development goals. The system, *bus, involved the development of a hardware device (a *box) containing a GSM modem and a GPS unit, that can be installed on a vehicle and used to track its location. The *box communicates via SMS with a server connected to a basic GSM phone. The server runs route a prediction algorithm and users can send SMS messages to the server to find when a bus will arrive at their location. The paper discusses the system and early testing, as well as the development implications for a range of urban and rural environments where transportation is scarce or inefficient, and where a central authority or institution is not in a position to provide robust information resources for users. We describe how the solution is also situated within technology usage patterns common to the developing world.

***Keywords*— GPS, GSM, WI-FI, embedded systems, sever and client application software and hardware unit**

1. INTRODUCTION

This Project presents an transportation systems localization system using GPS and GSM-SMS services. With ad-hoc network for no of transportation unit The system permits localization of the transportation and transmitting the position base station server and no of parameter SMS transmitted and received the sever as per requirement to the owner on his mobile phone as a his request. The system can be interconnected with the transportation vehicle alarm system and alert the owner on his mobile phone .via sever This tracking system is composed of a GPS receiver, Microcontroller and a GSM Modem. GPS Receiver gets the location information from satellites in the form of latitude and longitude. Processes this information and this processed information is sent to the user/owner using GSM modem. (SMS) Systems software received data and resulted speed also gets the speed of the vehicle and sends it to user/owner. The presented application is a low cost solution for transportation position and status, very useful in case of car theft situations, for monitoring adolescent drivers by their parents as well as in car tracking system applications. The proposed solution can be used in other types of application, where the information needed is requested rarely and at irregular period of time (when requested). This system is also can be interfaced with Vehicle airbag system. This enable it to monitor the accident situations and it can immediately alerts the police/ambulance service with the location of accident. Transportation of goods and people is key to economic and human development. This research discusses the development of the TIS system , a transportation information system that uses GPS, GSM, and SMS technologies. The TIS system will developed in response to transportation challenges experienced in villages, a developing region with poor infrastructure and limited resources; consequently, the findings in this research are extensible to other selected developing regions with limited resources, fragile road infrastructure, resource-constrained central government authority, and ad-hoc transportation resources for both inter- and intra-city transport.

2. AIM & OBJECTIVES:

- Exploring GPS based tracking systems
- Wi-Fi is using develop the ad-hoc network using No of object
- GSM used receiving and inform the real-time data as per authorize consumer
- Developing Automatic Transportation object Location system using GPS for positioning information and GSMWI-FI for information transmission server with following features:

- Acquisition of Transportation objects location information (latitude longitude) after specified time interval.
- Transmission of vehicle's location and other information (including ignition status, door open/close status accident, speed and automatic control for transportation systems) to the monitoring station/Tracking server after specified interval of time.
- Developing a window application based software to display all transmitted information to end user along with displaying location of vehicle on a map.
- Real-time transmission of vehicle position and performance data;
- Investigate the use of this technology in applications such as:
  a. probe vehicles to complement conventional real-time data
  c. driver route choice behavior;
  d. the study of the generation and scheduling of household trips

Each bus driver participating in the TIS transportation network will need to have a box device installed or placed on their bus with them at all times to allow riders to receive updates on their expected arrival times. At least one server, connected to a cell phone, also needs to be running at all times to receive location update messages from boxes and to accept and respond to queries from users. That server can be located anywhere in the country with cell coverage.

3. PROPOSED METHODOLOGY:

1) Box Driver Interface

The box will need to be designed to require minimal interaction with the bus driver. In order to use the box, the driver only needs to turn it on (using a button located on the side), and then enter a route number using a keypad as shown below in Figure1. The selected route number is displayed on a small LCD and stored locally on the box to be appended to each location update message sent to the server.

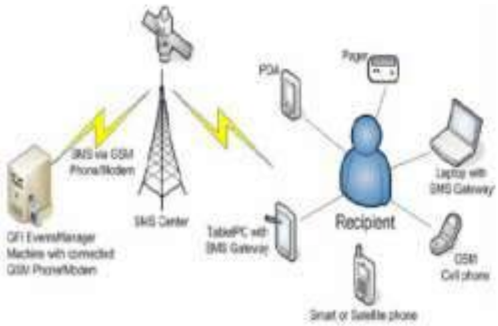

Figure1 : Prototype of the box.

2) Box Internals

In addition to being able to accept route numbers via a keypad and display the provided route number to the driver, internally the box must also 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 Telit GM862-GPS module. We chose to implement the TIS system with this very compact module because it provides a low cost solution with the additional convenience of combining GPS and GSM capabilities on one chip. Because no additional work is necessary to interface the GPS and GSM components, developing on this chip is relatively simple. The Telit module communicates with the keypad via general purpose IO to obtain the driver's currently selected route number and stores the number in memory. An ATMega16 micro-controller is used to coordinate the communication between the Telit chip, keypad 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 currently selected route number to the server via an SMS message.

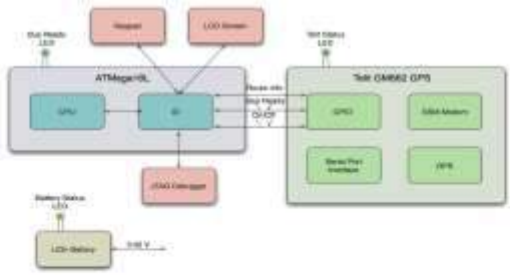

Figure2: box Internals.

3) TIS Server

The primary purpose of the server is to accept SMS messages coming from boxes and bus riders, and to process them accordingly. System requirements are intentionally minimal: a laptop or desktop computer running a visual basic 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. To minimize SMS latency, it is recommended that the phone connected to the server be on the same cell network as the boxes, although this is not required. The server does not need to be connected to the Internet, facilitating its deployment in areas with low Internet connectivity. Our prototype server may be implemented using such an application framework which will allow SQL queries, notifications, remote code execution and rapid application development to be executed over SMS. The server will be responsible for handling the following types of requests which arrive via SMS messages.

1) Location Update Messages from boxes

Messages sent from the boxes to the server have the following format:

!LOC,<GPS-obtained-time>,<GPS-obtainedlocation>,< bus-id>,<route-#>

The bus-id field is the unique identifier assigned to each individual bus that is equipped with a box. We would expect that bus drivers would display this bus id (in addition to their route number) in a way that it is accessible to riders. Riders will need the bus-id in order to associate a name to a location. The server records this information in a database for use in responding to user queries.

2) Arrival Time Queries from Users

Information gathered about the current location of buses in the system could be used to answer a variety of queries. The server continuously receives and replies to SMS queries from users. Potential bus riders simply text to a special TIS server telephone number, and the server responds by sending an SMS back to the user's phone number. The most basic example is to ask the server to predict the arrival time of the next bus travelling on a given route number at a given location:

NEXT <route-#> TO <location>

The server replies to the user with a SMS predicting:

Next <route-#> arrives to <location>at about <estimated-arrival-time>.

These examples demonstrate the types of queries we support in English, but the exact format and language can be changed.

3) Geo-coding Requests

We expect that there will be some locations frequented by many users that will have well-known names. These can potentially be associated with GPS coordinates in the server's database by the server operator. However, the TIS system will designed to work in scenarios where little or no geocoded street information exists. The solution to this problem is that we allow the clients to geo-code a location, on the fly, by using the GPS equipment already installed on the TISes. When a user wants to be able to refer to their current location in future TIS queries, they can associate a name of their choosing with the GPS coordinates of their location; they do this by becoming a secondary user of the GPS on the bus. The user can instruct the server to associate an arbitrary name to their current location by waiting until a bus arrives at that location and immediately sending the following SMS message to the server:

STORE <bus-id> AS <my-location>

bus-id is the TIS id of the bus that has arrived at the user's location. In this case, then, a user's location that she knows only by street name is now given GPS coordinates thanks to the GPS receiver on the bus. The server takes the bus's GPS coordinates at the time that the message will sent and associates it with the location name specified by the user. Such geo-coded locations can be retrieved in the future based on the location name and the user's phone number. Associating location names with phone numbers prevents naming conflicts between users, although other schemes are also possible whereby location names can be shared with other users, thus organically growing a set of tags for places of common interest. The TIS system could be used to map streets in a way that is comprehensible to all residents regardless of which naming system they use.

4. 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 [1] [2]. 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 [3]-[5]. 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, phone, or SMS/text message [6]. 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. References [7]-[13] describe arrival time prediction algorithms. Reference [14] describes the preferred mode of information for passengers in buses, at stops and passengers who are planning to travel. Reference [15] and [16] describe future work plan, related to security issues and also about how to apply this methodology for other possible fleet management.

5. FUTURE SCOPE

Future work on TIS includes examining possibilities such as incorporating some way to indicate the capacity of buses or allowing communication between drivers and riders, particularly for longer inter-city routes. A richer set of queries may be developed that allows users to subscribe to a notification system, so that they only need to send one SMS message to the server in order to receive several bus arrival time messages. Another potential expansion is to allow users to share tagged location data. Further investigation into making the system more scalable by using multiple phones per server for high density areas and by running stress tests is needed. Lastly, because the current system is based on SMS usage which generally requires a certain literacy level, further work could explore the possibility of voice interfaces. Whether moving goods to market or people to medical clinics, transportation is a crucial resource for any community. Allowing individuals to find ways to maximize such shared resources is the goal of TIS. Our approach has been a method of problem-solving that is bottom-up, that conceptualizes a technology device as shared among the community, and that recognizes the importance of information in people's everyday lives. Our goal with this work has also been to bring to the fore the importance of transportation for both economic and human development – an area of ICT for development that has not yet received much attention.

6. DESIGNING A TECHNOLOGICAL SOLUTION

We designed a system with the goal of improving access to transit information for potential bus riders at a minimum of cost to users and without requiring the assistance of a central authority. For our solution, we chose three existing technologies appropriate for Bishkek (and for much of the developing world as well) and augmented them with two new components we developed. We describe these engineered components later in Section V. 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. As discussed in Section II.D,mobile phone ownership and text messaging is common in Bishkek. Text messages are perceived as relatively cheap, costing anywhere from US$0.01 to $0.06 to send a message, and for many plans it is free to receive messages. Cell coverage in Bishkek is also excellent, and the country overall has good coverage. Good urban and rural cell coverage is becoming the case in much of the developing world. Additionally, in the ICTD community, SMS-based solutions have proven robust, flexible, and valuable to multiple communities . Work such as Frontline SMS and Warana Unwired demonstrate that information delivered via SMS can have a tangible, positive impact on individuals' lives .Although the mobile web is a compelling solution space for some, our research in Gadchiroli and elsewhere points to the value of solving for cheaper devices and more lightweight technology solutions that dovetail with technology patterns already in place. 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 [16].

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 buses participating in the system. GPS was chosen over other methods of location determination, such as GSM triangulation [17], 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 bus riders to leverage GPS units in buses to "tag" locations they are interested in querying about in the future (see V.B.3)). 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 *bus 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 communications is the most popular mobile phone network standard. Most mobile phones, including those commonly used in Gadchiroli, are on GSM networks. In 2005, the GSM family of technologies had more than 1.5 billion subscribers, more than the total number of Internet users world-wide

7. APPLICATIONS

- Transportation vehicle tracking and information.
- Vehicle Automatic and control via server
- Military: Monitor Troop Movement
- Search and Rescue
- Weather Balloon Tracking
- Wildlife Monitoring
- Real- time SMS based status of Transportation.

8. IDEAL BLOCK DIAGRAM

This figure3 incorporates the three existing technologies mentioned above with two new components. These engineered components are: a GPS vehicle tracking box (*box* pronounced "Starbox") and a back-end server that aggregates the location of the boxes, runs a route prediction algorithm, and provides the querying service to riders. The goal of the TIS system is to track buses' GPS coordinates and to provide users an SMS messaging system that will tell them when a bus should be arriving at their location.

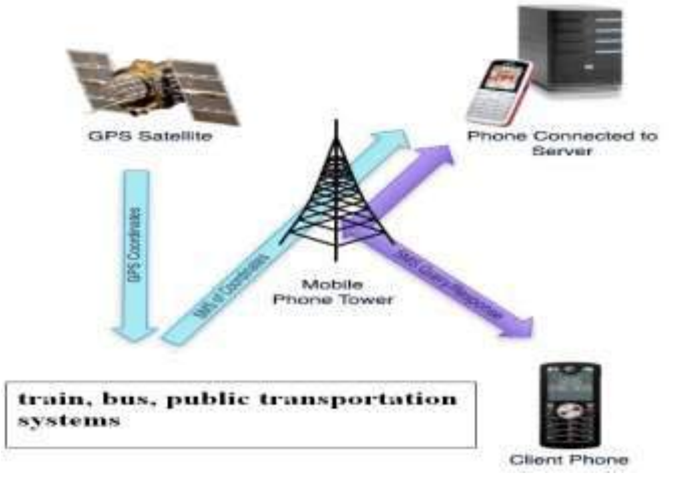

Figure3: Overview of the TIS System

The box will be a low-cost vehicle tracking solution that utilizes GPS satellites to locate box-equipped vehicles; the box hardware includes a GPS device and a GSM modem integrated into a single package that just requires a local SIM card. The GSM modem allows the box to 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 boxes and stores it in a database. The server consists of a laptop computer connected to a mobile phone capable of sending SMS messages and that serves a gateway to the SMS services. The server will be such that it does not need to be connected to the Internet, and the service does not require cooperation with mobile providers. Potential bus riders can use their cell phones to send SMS queries to the box server and receive transit information in response. Initially, the system will just support riders' queries for transit arrival times, but 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.

9. TECHNOLOGIES

Software – vb.net application software

- Client
- Sever
- Android

Hardware

- Embedded technologies
- Control systems
- Sensor
- Vehicle real-time model
- GSM modem
- GPS receiver

Wireless technologies

- GPS
- GSM
- WI-FI

Communication protocol

- UART
- AT –Command

10. CONCLUSIONS

The *bus system is a direct response to an articulated problem in the developing world, and it takes into close consideration technology usage patterns and technology infrastructure available in such resource-constrained environments. The system recognizes that information is valuable, and that the lack of information inhibits certain kinds of growth and efficiencies. However, there are not always central authorities or institutions with the resources or motivation to supply information infrastructure for citizens, and the *bus system provides a mechanism by which decentralized operators of a transportation system can create information resources for themselves. It is also a system that uses mobile technology in a way that does not require the direct participation of the mobile provider, thus cutting out one potential barrier to adoption. Finally, *bus enables community use of a single GPS system to allow for user-generated geo-coding of the environment.

11. ACKNOWLEDGMENTS

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