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Towards a Secure Travel Assistance Device for GPS/GPRS Enabled Mobile Users to Aid Transit Riders with Special Needs

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Abstract— As urban living environment is becoming more and more complex; the road condition is becoming worse because of heavy traffic, tremendous increase in accidents and most importantly the security issues that have been raised by recent incidences. To solve such problem with respect to school going children, a school bus tracking system has been developed. The system provides ANDROID Applications for the device in a bus as well as for parents of children travelling by the bus. A school bus tracking system determines the position of the bus with a GPS/GPRS enabled cell phone and displays the position on a Google map. This School Bus tracking system not only meets the security expectations of parents by providing features as Alert Messages and Conformance of Attendance of the Child on the bus, but also provides convenience to parents as it notifies when school bus comes near the house.

Index Terms— Android, GPS, GPRS, QR code, Google maps.

I. INTRODUCTION

The motivation behind this project is to assist and guide parents/guardians of school going children about vehicle position i.e. location of bus through which these children travels. System works with child phone (with Android O.S.) i.e. device to be tracked and parent phone (with Android O.S.) i.e. device used by user to track child phone. Both devices will be installed with developed android application. Server plays vital and important role of information management and communication between the child and parent phone. Child phone will be mounted with vehicle which is to be tracked. And parent device will be used by end-users which will track the related child. Child phone again uses the GPS or GPRS services to avail the co-ordinates. Usage of GPS or GPRS is been decided depending upon the accuracy they provide at run-time. Parent device will generate appropriate notifications as per position and condition of child device i.e. vehicle to be tracked. Co-ordinates will be sent by server to parent device using Google Cloud Messaging (GCM). Concept of QR code will be used to validate entry and exit of child in vehicle. This QR code will also satisfy real time situations very well. New technology Co-ordinates fetched by child device, sent to the parent phone will display exact position of vehicle on Google maps.

II. PROBLEM DEFINITION

Android tracking applications has reached new scale. Various applications has been researched and developed to track different objects. System uses GPS\GPRS services in the process. If we look at the modern traffic complexity and situation, need of advanced application comes up. This paper discusses new methodologies to tackle these situations. It introduces and describes the internet-based Client-server methodology using Java-Android Platform with inclusion of new technologies such as QR code and Google Cloud Messaging (GCM).

III. MATH

Distance calculation is major concern of this application and it is mainly intended to be energy efficient. Formula used to calculate distance includes very tedious calculations due to involment of many trigonometric functions. This application is very little concern about accurarcy as it requires to generate a notification over a comparatively wide range of 0-1100 meters. It gives rise to the new formula/concept. After bus is located in the specified range about the predefined point, generation of notification is carried out on the parent-device. This formula plays a vital role in security of child as well as it asserts energy efficiency of the application.



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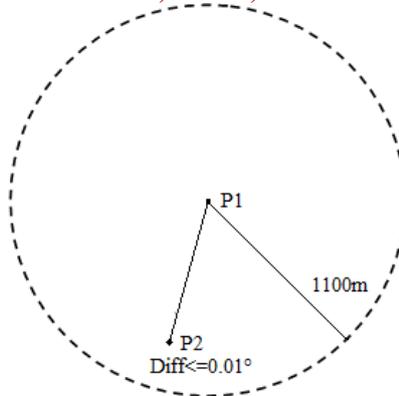


Fig.1. Proposed Architecture

1. Calculate distance between Latitude of points

$$\Delta\theta = |\theta_1 - \theta_2|$$

2. Calculate distance between Longitude of points

$$\Delta\lambda = |\lambda_1 - \lambda_2|$$

$$\text{Diff} = \Delta\theta + \Delta\lambda$$

4. If $(\text{Diff} <= 0.01^\circ)$ then P2 is expected to be within the range of 0m to 1100m from P1.

IV. OBSERVATIONS AND RESULTS

Table.1 Evaluation of Related Work

Place1	(Latitude, Longitude) (θ_1, λ_1)	Place2	(Latitude, Longitude) (θ_2, λ_2)	$\Delta\theta = \theta_1 - \theta_2 $	$\Delta\lambda = \lambda_1 - \lambda_2 $	$\Delta\theta + \Delta\lambda$	Distance (m)
Sinhgad College	(18.4684, 73.8351)	Jadhav Nagar	(18.4676, 73.8286)	0.0008	0.0065	0.0073	809.14
		Bhansali Campus	(18.4695, 73.8308)	0.0011	0.0043	0.0054	619.382
		Jadhav Gadh	(18.457, 73.8358)	0.0114	0.0007	0.0121	1211.14
Rajaram Bridge	(18.4879, 73.8299)	Japnese Garden	(18.4932, 73.8355)	0.0053	0.0056	0.0109	866.050
		Ganesh Mala	(18.4963, 73.8355)	0.0084	0.0086	0.0170	1356.000
		Vithal wadi	(18.4838, 73.8276)	0.0041	0.0023	0.0064	550.534
Deccan Karishma Society.	(18.5043, 73.8214)	City Pride kothrud	(18.4994, 73.821)	0.0049	0.0004	0.0053	541.614
		Nal Stop	(18.5091, 73.8319)	0.0048	0.0105	0.0153	1256.490
		Karve Chowk	(18.5017, 73.815)	0.0026	0.0064	0.009	631.126
Deccan Karishma Society.	(18.5043, 73.8214)	Fergusson College	(18.5267, 73.8418)	0.0125	0.0073	0.0198	1051.170

	Nal Stop	(18.5091, 73.8319)	0.0051	0.0172	0.0223	1898.690
	MacD JM Road	(18.518, 73.844)	0.0038	0.0051	0.0089	477.193

V. DESCRIPTION

A. QR Code

QR code stands for Quick Response Code which is used to store information in faster way. QR code is nothing but rectangular part that contains black and white part in form of matrix. QR code can store information such as name, URL, image etc.

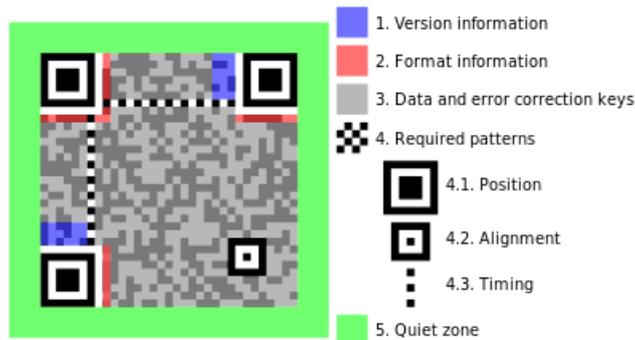


Fig.2 QR Code Structure

The major point comes in when we have to validate entry and exit of the person which is to be tracked in related vehicle. As per needs it is necessary to evaluate the person’s presence in vehicle, because there comes some situations when the person to be tracked might leave vehicle before its decided stop. Idea of QR code comes in picture to handle such situation. Every user to be tracked will be provided with unique ID which stored in form of QR code. This QR code can be printed on ID-card. QR code scanner will be provided in tracking application which will be mounted in every vehicle as child device to be tracked. Whenever person enters in vehicle it can scan its QR code printed on ID card by this child device. It will trigger the application and will inform server that person with particular ID has entered in vehicle and server should manage track data for this person with that vehicle. Parent device or user will get track information of that particular device with help of its unique ID. At the exit point the person in vehicle or to be tracked can again scan the QR code to indicate end of the journey. This simple process helps to validate entry and exit of person in vehicle which is to be tracked. There can be different layers to be considered such as bus failure. Such situation can also be considered with help of QR code method. Every Unique ID stored in QR code will help to track particular person. Tracking procedure will now be focused on person but not on only bus. Uniqueness of bus and route for particular person to be track won’t be needed with this method. It will solve many problems.

B. Google Cloud Messaging (GCM)

GCM is as service that allows sending data from servers to the android devices. It provides service to send lightweight data such as notifications as well as messages containing up to 4kb of payload data. GCM provides facility of sending data over the network by taking Registration ID as key. GCM stores the data if the target is not connected to the network and pushes the data as soon as it gets connected. GCM provides facility of Push Notifications. Most important feature of GCM supports high flexibility. It does not provide any built-in interface to handle the message data but it provides control of handling to the android applications.

VI. SYSTEM ARCHITECTURE

An android application of School Bus tracking is featured as to play the role of child-device and/or parent-device with the Same Interface. Both devices are provided with Device Communication Modules separately as per their role of acting. Major requirement of security is fulfilled by higher degree of authentication which leads to enable live tracking by an authorized user after accepting the request of Parent By the Child phone.

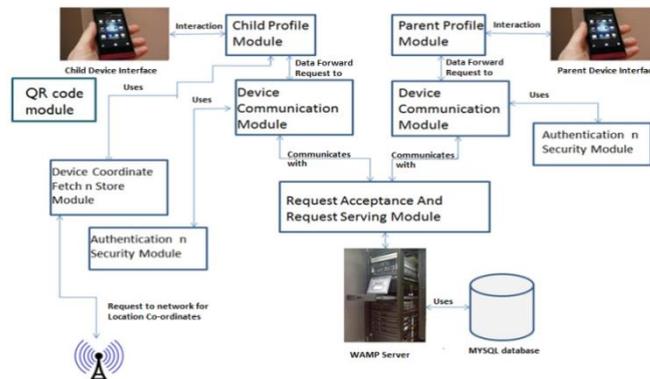


Fig.3 system architecture diagram

GPS and/or GPRS facilities are used to fetch the network co-ordinates. Enabling both the services for fetching co-ordinates provides the greater flexibility to choose between the criterias required as per the need of the application. QR codes are used to scan the identity card of the student and it will be used as a key to look for the entry in the database . Request coming from both types of devices are categorized and processed accordingly. The system architecture focuses on combining simpler functions together so as to provide a strong answer to the question of security.

VII. CONCLUSION

Vehicle tracking system resulted in improving overall safety and security of school going children. As the system is focusing on every individual there is no limitations for unique path and vehicle. It results into an efficient application which can serve best for personal as well as business purpose.

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