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A Real-Time Optimal Route Computation for Public Transport System Using Web

K. Nalini[1], A. Sai Suneel[2], S. B. Sridevi[3]

[1]M.Tech., Assistant Professor, Department of ECE, SE&T, SPMVV, Tirupati, India.
nalli.katta@gmail.com
[2]M.Tech., Assistant Professor, Department of ECE, SE&T, SPMVV, Tirupati, India.
saisuneel.adem@gmail.com
[3]M.Tech., Assistant Professor, Department of ECE, SE&T, SPMVV, Tirupati, India.
sbsridevi@gmail.com

Abstract

In this work describes web-map public transport enquiry system as described in this paper, gives a good example of providing bilingual information and public transport run in the form of interactive maps and texts, as well as real time derivation of optimal travelling routes for users in terms of multiple criteria, i.e., preferred mode, least changes, shortest travelling time, or lowest fare. This paper describes a research on The Flexible Bus Systems (FBS) using SMAC as a communication medium. The Flexible Bus System is a demand responsive transit (DRT) but it is more efficient and convenient in a sense that it entertains passenger's demands and gives bus locations in real time. The real time synchronization of The Flexible Bus System makes it information rich and unique as compared to other DRTs. The Flexible Bus Systems is a system that can replace the Traditional Bus Systems with its flexibility and efficiency. This paper discusses the use of wireless technologies in The Flexible Bus Systems and how to make it more reliable using short range wireless technology SMAC protocol.

Key words

GPS, GSM Modem, IR Sensors, ZIGBEE, AT89S52 Microcontroller, Interactive web map, multicriterion, multimode, public transport, route computation.

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1. INTRODUCTION

The main objective of this paper is to do a research on the use of short range wireless technology called "SMAC" [1] in Demand Responsive Transit (DRT), making it much more efficient, reliable and less expensive. This research is not the only way to develop this kind of a system and by no means suggested the best solution but it can definitely be one of the better alternatives we have till date. This research will also help us understand the potential of protocol. Till now SMAC is being used as in-house or in-vehicle technology but this research brings an idea of using SMAC as communication tool for Inter-Vehicle and Vehicle to Infrastructure.

This system enables the passengers to effectively use the public transport system and reach the destination on time using GSM [2]. The user should use PC (placed at the bus stop in real time) and enters desired destination using keyboard. These details are sent to the PC (at bus stop) from the microcontroller using SMAC. The name of the destination requested is sent to the buses with that name through SMAC [1] protocol using PC. The location of the bus from the bus module is sent to the Bus stop module using wireless protocol and displayed. The GSM modem [2] connected to the bus stop module can be used by the user to access the same data wirelessly through cell phone. A comprehensive and presentable public transport information system is deemed invaluable for local residents and tourists all over the world. This is particularly necessary in the view of the complex city structure and transportation modes available, all with different operation schedules, fare structures, and routing characteristics. To assist commuters in making better use of public transport, the system needs to be not only user friendly and the informative but intelligent enough to provide optimal route choices in terms of users' travelling behavior or preferences as well. The web-map public transport enquiry system as described in this paper, gives a good example of providing bilingual information and public transport run in the form of interactive maps and texts, as well as real time derivation of optimal travelling routes for users in terms of multiple criteria, i.e., preferred mode, least changes, shortest travelling time, or lowest far.

2. SUB SYSTEMS AND DATA BASE CONSTRUCTION

To develop such a multimodal travel information searching engine, much resource is spent on not only data collection but also rule formulation and algorithmic development of what constitute optimal routes and web (including web-map) design. Regarding the information required, the PTES essentially consists of three bilingual subsystems.

2.1. Public Transport System

This contains the following databases:

1) All the route names, direction types (one-way, two-way or circular), and stop sequences for all modes, i.e., rail, bus, tram, and ferry.

2) stop-to-stop fare for all routes, taking into account of all fare structures,

3) Geographic database storing the positions accuracy of roadside and section these reside on.

4) Other useful information such as stop name, address, district, and sub district.

This information mainly come from various transport operating companies, the Transport Department, city guide map books, and onsite checking and verification.

Web-based transit information systems, aiming to assist users to make better use of public transport, are receiving popularity. Route matching over a large network is endowed with many practical considerations. First is the problem of multiple criterion trip planning. It should be noted that most existing web-based trip planning methods compute the least time or shortest distance path for users, i.e., a single-criterion least cost path. In real situations, passenger cares about multiple attributes and likes to be provided with a reasonable number of choices for comparison. The second problem is that transit routes normally have a non additive fare structure, which cannot be well represented in a traditional network model and analyzed by shortest path algorithms. The third problem is about large complex transit networks and computational efficiency.

As trip planning for individual passenger needs to be of high spatial and temporal accuracy, the corresponding network representation of a transit system requires high spatial and temporal resolution. That leads to very large networks, which might affect the response time. This section therefore presents way son how we tackle the challenges of meeting the simultaneous requirements of multiple-criterion path evaluation, complex fare structure, and computation efficiency over a large transit**.**

2.2. Address Subsystem

It is a database of names for user selection of origins and destinations. This includes all popular tourist sightseeing or shopping places supplied from the Hong Kong Tourism Board, street names, site names, and all building names and landmarks, most of which are based on the data supplied from the Land Information Centre, Survey and Mapping Office of the Lands Department. The district and subdistrict in which these points of interests (POIs) belong to are derived by spatial analysis from a geographic information system. Similarly, a geographic database containing their positions is developed. However, to enable route search, special effort is required to move those large landmarks or POIs closer to the stops, i.e., within the searching buffer.

2.3. Map Subsystem

The PTES is making use of the Internet mapping system (which is sometimes referred to as web-enabled geographic information system (GIS) or online GIS application). It is a Web application fully charged with GIS functionality in the late 1990s, some of the releases of these applications were emerging by extending the traditional GIS packages to support Web technology. Examples include the Environmental Systems Research Institute (ESRI)'s ArcView Internet Map Server version 1 [3] and MapXtreme Java Edition 1.0 from MapInfo Corporation [4]. Basically, the Internet mapping system follows the client–server model with web browsers as the clients and the web site serving the application as the server. There are two variations to the basic Internet mapping application, i.e., client side and server-side applications [5]. A discussion about the visualization design issues for online GIS, taking into consideration its interactive computational-intensive characteristics and the requirement on high-resolution graphical user interface, can be found in the works of Bosak [4] and Pun-Cheng and Shea [6] . Web mapping has become a more and more popular way of providing information to a large group of users. The map on the Internet functions as an interface or index to additional information. In particular, interactive maps will allow "mouse over" or "click" that leads to further information or even computation from users' requests. The PTES is a good exemplification of this interactive mapping system. Edited from the 1:5000 base maps of the Survey and Mapping Office, two series of seamless maps, i.e., 1:3000 and 1:7500 covering the whole area, are prepared for real-time computation of possible routes according to the (*x, y*) locations when users specify O–D on the map, as well as for displaying the route search result. These maps are updated four times a year and designed in a way that only significant addresses such as major roads, building names, site names, prominent landmarks, and public transport information are highlighted. In addition, when listing out the stops of a particular route, each stop is linked to the map showing its position. These three subsystems form the essential databases for route computation. With the available (*x, y*) locations of all transport stops, POIs, and mapped positions, a real-time spatial search involving cross referencing between the different database tables can be performed to provide users the best possible routes.

3. EXISTING SYSTEM

The paper presents a solution implemented at Sri Lanka, to provide an intelligent Train tracking and management system to improve the existing railway transport service. The solution is based on powerful combination of mobile computing, Global System for Mobile Communication (GSM) [2], Global Positioning System (GPS) [7], Geographical Information System (GIS) [8] technologies and software. The in-built GPS module identifies the train location with a highest accuracy and transfers the information to the central system via GSM. The availability of this information allows the Train Controller to take accurate decisions as for the train location. Location data can be further processed to provide visual positioning using maps granting a wholesome view on train location. Positioning data along with train speed helps the administration to identify the possible safety issues and react to them effectively using the communication methods provided by the system.

Disadvantages

- The location data provided by this system lacks in dependability.
- The maintenance of the system accounts to a large portion of total cost incurred on the railway service.
- The system doesn't identify the no. of passengers present in the train.

4. PROPOSED SYSTEM

In this research is not only way to develop this kind of a system and by no means suggested the best solution but it can definitely be one of the better alternatives we have till date and can be used in the areas where there are no 3G[9], WiMax or other long range wireless technologies available. This research will also help us understand the potential of SMAC [1]. Till now SMAC is being used as in-house or in-vehicle technology but this research brings an idea of using SMAC as communication tool for Inter-Vehicle and Vehicle to Infrastructure. Using SMAC to communicate between Bus and the Bus Stop will also reduce the total cost of the system as SMAC devices are far cheaper than WiFi [10], 3G and WiMax [11] devices. Due to the fact that SMAC is low power as compared to other short range wireless technologies like WiFi, this system can be deployed in mountainous areas where power is a major concern.

Advantages

- The algorithm of Flexible Bus System is devised in a way that this system replaces the scheduled bus lines systems and buses can dynamically change their routes according to passenger's demands.
- Passengers are informed about the real time location of the buses which makes it easy for the passengers to decide
- Whether to ride a particular bus or not making this system passenger friendly.
- It is reliable and time saving.

4.1. Transmitter Section Block Diagram

The Fig 1 shows transmitter section having IR Sensors [12], AT89S52 Microcontroller, UART, SMAC, GPS, LCD, 1*5 Key boards.

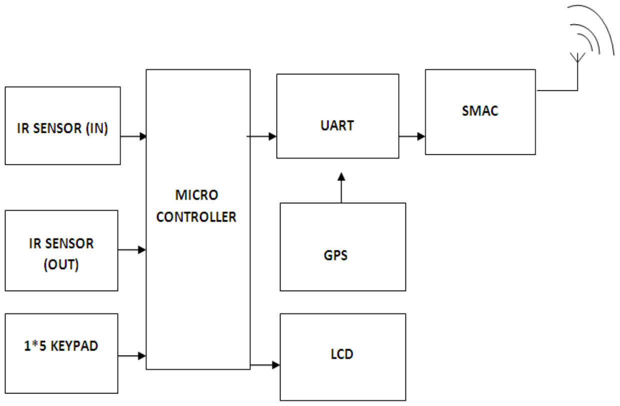

Fig 1: Block diagram of Transmitter Section

4.2. Receiver Section Block Diagram

The Fig 2 shows Receiver section having AT89S52 Microcontroller, UART, SMAC, PC, GSM, Voice board.

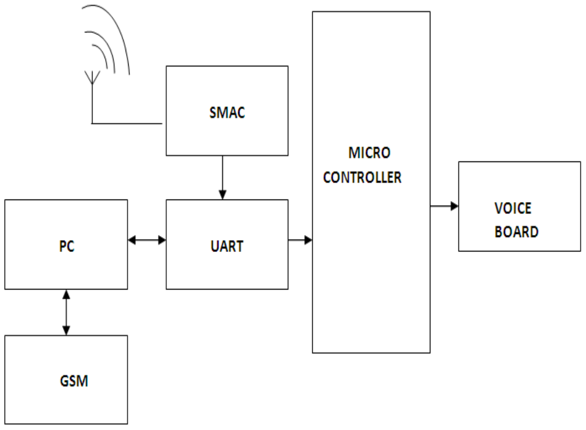

Fig 2: Block diagram of Receiver Section

5. Experimental Results

The designing of the hardware transmitter and receiver section as shown in the fig 3 and fig 4. The algorithm for the operation of the transmitter and receiver section shown below

Step 1**:** To store the final result

Step 2: To recording point is required for our Algorithm

Step 3: Declare the simple delay function

Step 4: Declare the IR control pin going to sensor

Step 5: Declare the IR output pin going to sensor

Step 6: Setting IR value

Step 7: Detect the obstacle

Step 8: Pin3 of port 2 will go HIGH turning ON a LED

Step 9: Sensor is saturated by ambient light

Step 10: The way is clear in front of the sensor

5.1. Transmitter Section

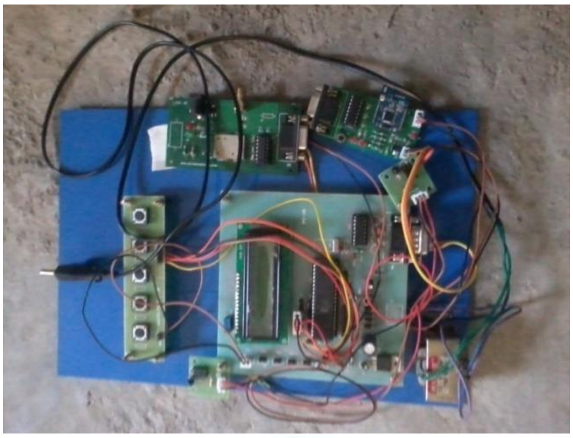

Fig 3: Transmitter section of bus

5.2. Receiver Section

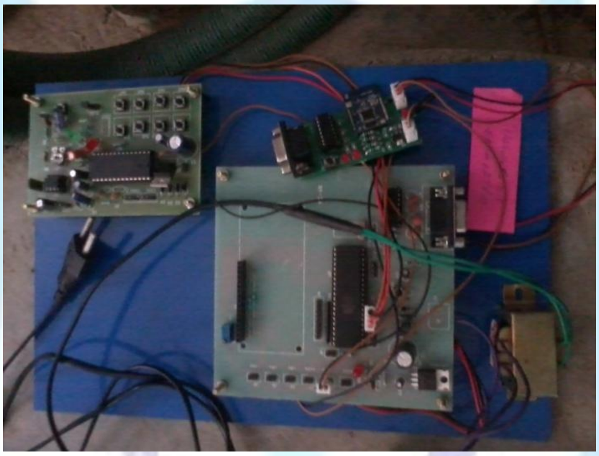

Fig 4: Receiver Section of bus

5.3. Out Put

Fig 5: output on pc

6. CONCLUSIONS

In this, the hardware and software design of an embedded monitoring system for real time applications is presented. Vibration signals have been analyzed to detect the mechanical faults. The implementations of analysis technique in time and frequency domain are given. The proposed system imbalance detection technique is verified with different level of severity.

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Author' biography

Mrs. K. Nalini

Mrs. K. Nalini received the B.Tech(EIE) from Bojh Reddy Engineering College for Women, JNTU Hyderabad, India, in 2007 and M.Tech(DECS) from Sree Vidyanikethan Engineering College, JNTU Anantapur, India, in 2010. She is currently working as a Assistant Professor in School of Engineering and Technology, Sri Padmavati Mahila VisvaVidyalayam, Tirupati, India. She has been active in research for more than 2 years and published 2 journals, 2 national conferences, 1 international conferences in the field of Communications and Digital Image Processing. Her research interestes include Ad Hoc networks, Embedded Systems, Mobile Cellular Systems.

Mr. A. Sai Suneel

Mr. A. Sai Suneel received the B.Tech(ECE) from Kuppam Engineering College, JNTU Hyderabad, India, in 2007 and M.Tech(DECS) from Sree Vidyanikethan Engineering College, JNTU Anantapur, India, in 2010. He is currently working as a Assistant Professor in School of Engineering and Technology, Sri Padmavati Mahila VisvaVidyalayam, Tirupati, India. He received L V Prasad Memorial Gold Medal in the year 2010. He has been active in research for more than 3 years and published 6 journals, 6 national conferences, 2 international conferences in the field of Communications. He is a Life Member in Indian Society of Technical Education (ISTE).His research interests include Ad Hoc networks, Embedded Systems, Mobile Cellular Systems, OFDM based Systems and Digital Image Processing.

Ms. S. B. Sridevi

Ms. S. B. Sridevi received the B.Tech(ECE) from Siddhartha Institute of Engineering and Technology, JNTU Anantapur, India, in 2010 and M.Tech(DECS) from Sree Vidyanikethan Engineering College(Autonomous), JNTU Anantapur, India, in 2012. She received L V Prasad Memorial Gold Medal in the year 2012. She is currently working as a Assistant Professor in School of Engineering and Technology, Sri Padmavati Mahila VisvaVidyalayam, Tirupati, India. She has been active in research for more than 2 years and published 4 journals, 3 national conferences, 1 international conferences in the field of Digital Image Processing. Her research interests include Ad Hoc networks, Embedded Systems.