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Full Length Research Paper

Public transport monitoring with route and dispatch management system

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Nowadays, the operating scales of the public transport providers can hardly meet the market demand because of the fast expanding volume of intercity passengers, the laggard bus dispatches and proper route management systems. From the societal perspective, this paper, under the framework of a public transit network with bus service providers and users, presents an integrated busses network management system with poles apart intrusion detection system (IDs) using satellite-based technologies applied. The core software designed is to provide the passengers to observe the approximate location of their desired buses, which also requires customizing hardware at every bus station found at the particular routes and reporting stations. The route's management based solutions for the bus monitoring system are aimed to bring convenience and efficiency to both passengers and transport providers in terms of a decision support system, and thus improve the civic transportation environment and infrastructure.

Key words: Buses monitoring system, global positioning system (GPS), RF transceivers, route management, decision support system for passengers.

INTRODUCTION

Kuala Lumpur's public transport network is one of the complicated but most useful urban transport systems in the world. Nowadays, around 2 Million daily customers are observed travelling by the economically planned public transport. The Kuala Lumpur Structure Plan 2020 for the transportation (Kuala Lumpur Structure Plan, 2020) is the blueprint that will guide the development of Kuala Lumpur's public transport system for the next 20 years. The Plan, with its two-pronged approach, outline the goals, strategies and policies towards achieving the vision as well as identifies ways to minimise or solve issues and problems faced by the passengers. It is stated in the introduction of the plan that "Comprehensive and efficient transportation system networks with good inter and intra city linkages are essential enabling factors to ensure Kuala Lumpur's position as an international commercial and financial centre" (Section: 10.1; 382 and 383) So in order to chase the targets and to make the system more efficient to overcome the upcoming problems faced by the authorities as well passengers, several measures had been taken in the past like lowering the entry and exit thresholds, relaxing the regulation on fares and managing their routes. This as a result increases the public demand towards road transportation, which led many new bus companies as well as existing local bus companies enticed to join this new open market. Now the extracted problem statement not only belongs to the KL but the

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Abbreviations: GDP, Gross domestic products; **GPS,** global positioning system; **GSM,** global system for mobile communications; **BMS,** bus monitoring system; **BIS,** buses information system; **ITS,** intelligent transport system; **IT,** information technology; **RF,** radio frequency; **RFID,** radio frequency identification; **AVM,** automatic vehicle monitoring; **GPRS,** general packet radio service; **RBFNN,** radial basis function neural networks; **CDMA,** code division multiple access; **PRN,** pseudo-random; **UTC,** coordinated universal time; **SMS,** short message service; **LAN,** local area network; **PAN,** personal area network; **MCU,** multipoint control unit; **IDs,** intrusion detection system; **LCD,** liquid crystal display; **NMEA,** national marine electronics association; **V1,** index variable.

same or worst public transport network management situation can easily be observed in most of the metropolitan cities of the world.

In order to achieve an optimal design of a public transport transit system, researchers in the last several decades proposed many design and optimization approaches using performance evaluation and technology utilization, which could be capable of holding the increasing burden of passengers. It can also give long term comfort to the city government by encouraging people to use public transport instead of own car, which will lead to less congestion, less fuel and energy utilization as well benefits to the public transport providers. A model of such a requirement which highlighted the problem statement can be observed by an over view to the Government Funding for Intelligent Transportation Systems Development (Ezell, 2010). The leading countries in intelligent transportation systems have not only developed an explicit national strategy for IT'S, they have also invested heavily in it. South Korea's National ITS Master Plan 21 commits to investing a total of $3.2 billion from 2007 to 2020 in intelligent transportation systems, an average of $230 million annually over the fourteen-year period. Japan invested ¥64 billion in Intelligent Transport System (IT'S) from April, 2007 to March, 2008 and ¥63.1 billion in IT'S from April, 2008 to March, 2009, on average about $690 million annually. Aggregate investment in ITS at all government levels in the United States in 2006 was approximately $1 billion (including $110 million in federal funding and over $850 million in funding from the U.S. states). As a percentage of Gross domestic products (GDP), South Korea and Japan each invest more than twice as much in intelligent transportation systems than the United States. Some gave the frame work for safety issues to increase the performance percentage of overall public transport network (Hsin-Li et al., 2005).

The associations between safety performance and company characteristics, including the type of operation and the size of the fleet, were also explored recently in (Corsi et al., 2002) for passenger motor carriers. Some theoretical solution on the provision of bus services along different routes that comprise a public transit network is assessed considering in (Chintan et al., 2007), along with the service providers, the users and the societal perspectives. The study conducted for the implementation of bus priority at traffic signals has grown steadily since the successful large-scale trial conducted in the SELKENT area of London (Hounsell et al., 1998). With the development of technology in the area of detection techniques, traffic signal systems and communication systems, a Global Positioning System (GPS) based technique was provided (Hounsell et al., 2007) to set the priority based solution for the London's bus's network. Athenian (Greece) transport network is based on the latest telecommunication systems, and it has about 300 intelligent bus stops equipped with screens and audio announcements to inform users about buses and timetables (Mintsis et al., 2004). A technical approach was raised (Stephen et al., 2007) containing an intelligent fleet management system which incorporates the power of concurrent GPS and Global System for Mobile Communications (GSM) real-time positioning, front end intelligent and web-based management software. Forecast model and policy guidelines for Building Buses information system/ Bus monitoring system BIS/BMS with Wireless Communication System in Korea was presented and bring a lot of achievements (Bong et al., 2007). According to this research, BIS and BMS are an integrated system applicable to existing bus operating systems that encompass GPS and information technology (IT) features such as information, computers, electronics, controls and so on.

It is a field in ITS that enhances the efficiency of bus usage. Ming et al.'s article (Ming Lu et al., 2007) is based on Positioning and tracking of construction vehicles in highly dense urban areas. In his paper, he reviewed the previous radio frequency (RF)-related research in construction and further evaluate the pros and cons of several RF-based technologies including GPS, radio frequency identification (RFID), and Bluetooth for monitoring and applying GPS for tracking only construction vehicles in a dense area but unfortunately most of these researches were little incapable of bringing the solution for real world problem related to Public transport network in terms of management as well monitoring because of growing latest technologies, rising population as well as increasing problems for the intercity public transit network in highly dense urban areas. This paper will examine the potential applications for bus information systems and the various technological approaches taken on selective vehicle location detection and the functionality that these can provide. Following on from this, it will explore the various implementation approaches taken by various KL Public Transport services. Regarding technological approaches, the improved accuracy of GPS technology has seemingly become as the preferred choice of location detection method for 'high-end' system. It will provide the individual vehicular position information by the means of Coordinates like described in (Hu et al., 2009; Niittymaki and Pursula, 2001; Bookbinder et al., 1992). However, still to make the overall system more compatible and reliable with the real world, the intelligent looping of several specially configured RF embedded radio chips are decided to include in the proposed solution. The use of a RF allows for a much more selective location transmission down to specific vehicles as well bring advancement in our frame work of the decision support system. The aim of our decision support system for the passengers is to propose an adapted answer to the problems related to the real-time bus network monitoring and management system, particularly in dense urban areas where GPS reception could not be up to the mark like the Multipath error can easily be observed. In order to challenge these exertions, the comprehensively proposed system comprises of two major parts; one is the technical while other is management of overall paradigm.

BACKGROUND

No one can deny with the importance of time in this 21st century. However, the problem with time management is its unwanted wastage for people's life due to plenty of reasons, including growing infrastructure of traffic and their poor management is one of the main reasons. Passenger at the bus station had been the victims of this unwanted wastage of time since long time, especially in the big cities where the public transport facilities are not compatible with the city's problem. Public traffic facilities with the high-tech and intelligence system with a proper management system have been a standard to estimate the development of the country and its international image. Nowadays, passengers want to get the clear information of the station like the estimated time of arrival of bus, etc. So quality services of any transit network, which can enhance the economic and social importance of any city or even whole country, typically rely on one or more of three elements to attract customers; (1) Improved service through increased frequency, faster journeys and greater reliability. (2) Better information both before and during journeys through a number of media, including printed timetables, the Internet and real-time information signs at bus stops. (3) Availability on pre determined time with the structured departure and arrival schedule. While measuring the service performance along a transit network, it is necessary to include both, that is, the provider's as well as the consumer's viewpoints (Balbo and Pinson, 2005) (Ming-Miin and Chih-Ku, 2009). This is because both viewpoints define 'efficient' service in a different way, if not contrasting manner. According to the provider's viewpoint, efficient service along a route is where the transit agency will provide adequate service at the least cost, whereas for the customer, efficient service along a route is where one that has the most quality attributes such as the shortest travel time with maximum information of required public transport, etc. A provision of such an example can be observed in literature cited. It is evident to many papers and articles that various measures and dimensions of performance had been proposed in the past when evaluating the performance of public transit systems. Especially performance criteria mentioned above.

Furthermore, these measures and dimensions reflect multiple perspectives such as the passenger, the service provider and society as discussed in (Chintan et al., 2007; Corsi et al., 2002; (Hsin-Li et al., 2005). A variety of approaches have been used to model urban transportation networks (Operation Research methods) utilizing several technologies comprising of fuzzy theory, ANN, GA, etc. The vehicles' monitoring system by Intel Regulators uses systems known as Automatic Vehicle Monitoring systems (AVM), which were developed in order, ensure the success of the transportation plan. AVM compares the actual positions of vehicles (captured by the sensors) with their theoretical positions. In this way, the regulator can see whether the vehicles are running ahead of timetables or are running late. However, this system was limited to coping with disturbances linked to unanticipated demands and to traffic conditions. Moreover, the collecting and shaping of data are insufficient to help regulators. Some research proposes solutions in (Bookbinder et al., 1992) for Transfer optimization, attempts to minimize the overall inconvenience to passengers who must transfer between lines in a transit network. Bus trips are scheduled to depart from their terminal to minimize some objective function measuring that inconvenience. Recently, GPS based solutions by the means of communication system are the most common and widespread ones nowadays for the vehicular navigational purpose. (Zhang, 2006; Hu et al., 2009; Kai et al., 2008) discuss the BMS utilizing GPS for gathering the location data and General packet radio service (GPRS) as the transmission tool. These researches provided somehow reliable solutions for the small scale fleet monitoring and their network management systems.

The effect of GPS location error is especially critical when a bus stop is close to another one in urban areas. These error effects of GPS on vehicular monitoring were explored in earlier research by the author in (Muhammad et al., 2009). The research showed that those effects can be reducing up to some extend by using the techniques of Radial Basis Function Neural Networks (RBFNN). The influence of GPS error is less noticeable where the existing journey time variability is high or the expected time of availability of bus is required. Xu et al.'s method in (Xu and Jiancheng, 2007) put forward on Error compensation of Velocity and position coordinates by the GPS using Neural Network. His research aimed an effective solution that can estimate and correct for the navigation errors caused by the initial misalignments as well as the inertial sensor's errors by utilizing neural network ensembles with the Kalman filter. Among all studies, some gave good answers for the effective wireless navigation system of the Buses' location while some provided optimization based ideas but these measures and dimensions have not been consolidated in an integrated framework where different views are considered along with multiple goals. For effective design of a decision support system, it is important to link the measures of performance described in the literature to a single monitoring system that represents multiple factors/dimensions of performance.

The framework that is proposed in this research lends itself to capture disaggregate performance measurement. For example, it can be applied to the evaluation of the services provided along a network of bus routes, organization for public transport provider, etc. Since it offers a unique idea for the effective communication for the vehicular navigation system based on a deep survey conducted in Federal Capital of Malaysia extremely focusing the benefits of passengers. Since the whole decision making support system mostly relays on the behaviour of Navigational and communication equipment, selected to utilize. Building on this research, further research was undertaken to study the effect of location error in the case when there is a bus stop close to the traffic signals. Based on those effects, this paper concentrates particularly on managing the practical implementation of existing technologies for bus monitoring. So the technologies utilized in the proposed Buses Network and monitoring management system, to overcome the flaws of previously discovered solutions are discussed shortly here;

The GPS system

The GPS system consists of 24 satellites in orbit around the earth. Positioning is available 24 h a day all around the world. GPS satellite actually transmits two power radio signals, termed as L_1 and L_2. The GPS used by the civilian is L_1, having frequency 1575.4MHz in the UHF-band. It contains a Pseudo Random Noise code along with Ephemeris and Almanac data. The receiver can discriminate the signals coming out from different satellites because GPS uses a Code Division Multiple Access (CDMA) spread-spectrum technique where the low-bit rate message data is encoded with a high-rate pseudo-random (PRN) sequence that is different for each satellite. Ephemeris data contains a very precise orbital and clock correction message as well important information about health of satellite while the almanac data consists of coarse orbit and status information for each satellite in the constellation, an iono-spheric model and information to relate GPS derived time to Coordinated Universal Time (UTC).

The user segment is utilized direct line of sight GPS satellite signals to determine the user position velocity and time with accuracies specified by various receivers. It measures the apparent transit time of the satellite signals to the user, described above as pseudo range, consist of the propagation delay and receiver clock bias. Nowadays, GPS receivers have been miniaturized to just a few integrated circuits and so becoming very economical. And it makes the technology accessible to virtually everyone. So within the framework of this paper, it is decided that application of GPS in the field of the public transportation system are presented and discussed. It must be mentioned at this point that GPS applications can be divided in four main categories, which are the following:

(a) Vehicle fleet management and monitoring.
(b) Data collection and mapping of the transport infrastructure.
(c) Incident management and monitoring.
(d) Vehicle navigation systems.

Communication tools

Wireless data communication technology is the core technology in collecting position data and operating information for most of the monitoring and management system. Nowadays, the wireless technologies are growing day by day. Much enhancement and innovations are going to be observed in the field of wireless. Besides satellite communication, long range point to point or point to multi point communication protocols to have been developed. The beacon resembles the RFID tag in functionality but operates on the Bluetooth for establishing communication links with the in-vehicle navigation unit. In addition, the real-time location and status of a particular bus can be transmitted to the bus station using short message service (SMS) over mobile phone networks (Zhang, 2006; Hu et al., 2009). In addition, wireless communication technologies such as Wi-Fi (IEEE 802.11b) and ZigBee (IEEE 802.15.4) have enabled wireless LAN (Local Area Network) and PAN (Personal Area Network) and are also widely used for tracking and automation applications. In particular, ZigBee holds the promise of providing a more cost-effective wireless sensor technology and replacing Bluetooth.

This change in scale of communication network activity has to be accompanied by technological changes to the management system. That is why many researchers are keen on utilizing these rising wireless technologies like in (Bong et al., 2007) especially in the transportation based navigation systems. The increasing utilization of this technology in almost every walk of life encouraged us to use in our research. For the purpose specially designed long range XSTREAM RF modules are selected. The XStream module provides OEMs and integrators with reliable, long-range wireless data communications. The module typically yields two- to eight-times the range of competing RF modules do in large part to its superior receive sensitivity. Since the system must be carefully examined for transceivers capacity to collect and transmit information about the operating dense urban area. So the onboard high tech Multipoint Control Unit (MCU) is selected, which is made fully compatible with the overall system as well the transmission modules through software. The novelty of the proposed frame work lies in the intelligent configuration of these embedded radio chips which are carefully made companionable for the better system design.

METHODOLOGY

Given the lack of an established body of research on the design of public transport network services and the small number of practitioners involved in this field, a quantitative approach seemed inappropriate in relation to the nature of the enquiry; thus, one based on grounded theory was adopted. The researcher needed to discover the principles underpinning the planning and design of the bus framework and to ‘‘allow the theory to emerge from the data’’. For the purpose being author focused two different approaches emerge regarding design. The first is referred to as the management of the whole monitoring and route system. In this phase, some rules and regulations are described as the initial system assumptions. The planning for several parameters is discussed to make the proposed frame work as resourceful as possible. Second is the hardware implementation for the overall system to work. This phase contains best functional component selection according to the proposed design.

Assumptions

As urban environment density increases, management techniques classically used by bus network regulators (the staff in charge of monitoring the bus network) became obsolete. The frame work presented in the methodology is based on the following some assumptions must be imposed by the regulators: (1) Each bus route is isolated entities, are assigned similar activities; (2) the inter-linked network of nodes represents the service along a bus route and hence the efficiency of the network is equivalent to that of the service provided along the route; (3) buses of same IDs are sent by a proper interval of time. In case, any two or more buses of same IDs join each other due to any reason then 2nd one need to stop for the time until first one reach at the next bus stations; (4) Bus drivers are strictly ensured not to change the pre-defined route. In case any emergency, they are restricted to inform to the monitoring room so that the monitoring plan could be a change to facilitate the passengers.

Proposed frame work: The concepts

The present market for bus information systems in the KL is very fragmented. There are quite less no. of systems with varying complexity providing solutions for public transport movement monitoring and route management systems. Although the financial cost of the more advanced system is beyond the budget of most local authorities, although there is a clear demand for some form of systems, which can bring simplicity with effectiveness for the transit service provider as well as passengers. For the purpose being a wide range solution by considering for many problems being surveyed by the author even for any naturally occurred fault like traffic jam or any other problem because of which Bus could not reach on the specified time and passenger faced the problems. Now the passengers are being fasciitis by the graphical display containing position data of their desired buses with maximum accuracy measures. Figure 1 describes the conceptual proposed frame work. The concept of the proposed methodology is carried out by managing the actual utilization of the entire technologies as described in the technical background. The frame work is designed such that the victim passengers can see their desired bus location on their Bus stops. The solution looks quite simple but when we go for the implementation plan we come to know about its challenges. It is observed that many buses having same IDs draw closer together. Sometimes Bus stops are found in front of each other across the road.

The conceptual solution suggested for the difficulties found, are the scheming of GPS based monitoring and their location transmission down to the specific bus stops only found on their routes, not even at the bus stop found across the road as exposed in Figure 1. This specific location transmission is actually the function of specially configured transceivers and initially inputs by the drivers. For the overall concept to be practical, the bus node is named as the master module while bus stops are defined as slave modules. The dispatching procedure is made compatible by using the prescribed assumptions. Through described resolutions, it will be easy for the passengers to take the decision either to wait for the bus or not. The concept of proposed designed decision support system will also facilitate the public transporters either private or managed by government in terms of monitoring their particular vehicles since the scheme is also capable of managing the display at any centrally organized monitoring system because of usage of power full technologies.

Frame work designing of integrated bus monitoring systems

The Bus monitoring and Management System assures the real time processing of data related to monitoring the position of the bus and more its implementation through the Route management system. The system is also capable of support the preparation of the daily operation's programme since the whole frame work is carefully designed to meet the challenges of referred problem statement from several aspects. In order to ensure the exact monitoring at the particular bus stations, several measures have been designed like at the starting of every journey, the driver is restricted to input some data using a keypad same as Unique bus ID, time of arrival and either UP or DOWN. Each vehicle (master module) in the fleet is equipped with on-board MCU that takes data from sensing device GPS as well as the driver, and can rigorously monitor the position of the vehicle. Looping of Radio links allows information to be sent to the only the specified bus stop (slave modules) only found on their particular routes, as shown in Figure 1. They are particularly configured to receive only the position data of unique ID being trained. The travelling public is informed on displays at bus-stops and bus-stations of the expected arrival time and position of their desired buses. Within the central control, the controller can see the current situation at a glance using graphical displays of the bus network and routes that show the location of buses and whether they are on schedule.

In summary, of the concept of frame work and its designing, the Bus operations and management system uses information technology to provide a permanent as passengers who integrate the operations, passenger information and system management functions of the public transport company. In the practical monitoring system using GPS, we it can be set certain time intervals to update Latitude, Longitude and Time data according to need in order to get the space positioning data. The GPS module used follows the NMEA0183 protocols. In most of the navigational systems, the positioning data we are concerned about such as latitude and longitude, speed, time can gain from the "$GPRMC" frame which GPS receiver sends to the MCU .So our bus positioning data can easily be selected by using this frame. Output baud rate is 4800. MCU communicates data with GPS module by the serial port. This is the standard asynchronous communication mode. Set the same baud rate of MCU with GPS output baud rate, then GPS module will send positioning data to MCU by the serial port. It is programmed to allow MCU to receive and store data, and then bus location will be calculated. Complexity is ensured to reduce by dividing the whole presented system in into two basic parts; master part and slave part 1, 2 and so on, as described in the concept, depending on the number of Bus Stations as shown in Figure 2.communication between vehicles and the operations centre as well

Master module

This designed will provide the right answer for the multifaceted problems found in the existing BMS. Since the whole decision support system is typically divided into two basic parts, out of one is the master. This part is embedded on every bus. The system comprises the 32bit PIC produced by Microchip. MCU is responsible for receiving information, means it will receive the positioning information send by GPS module to MCU, deal with the input of

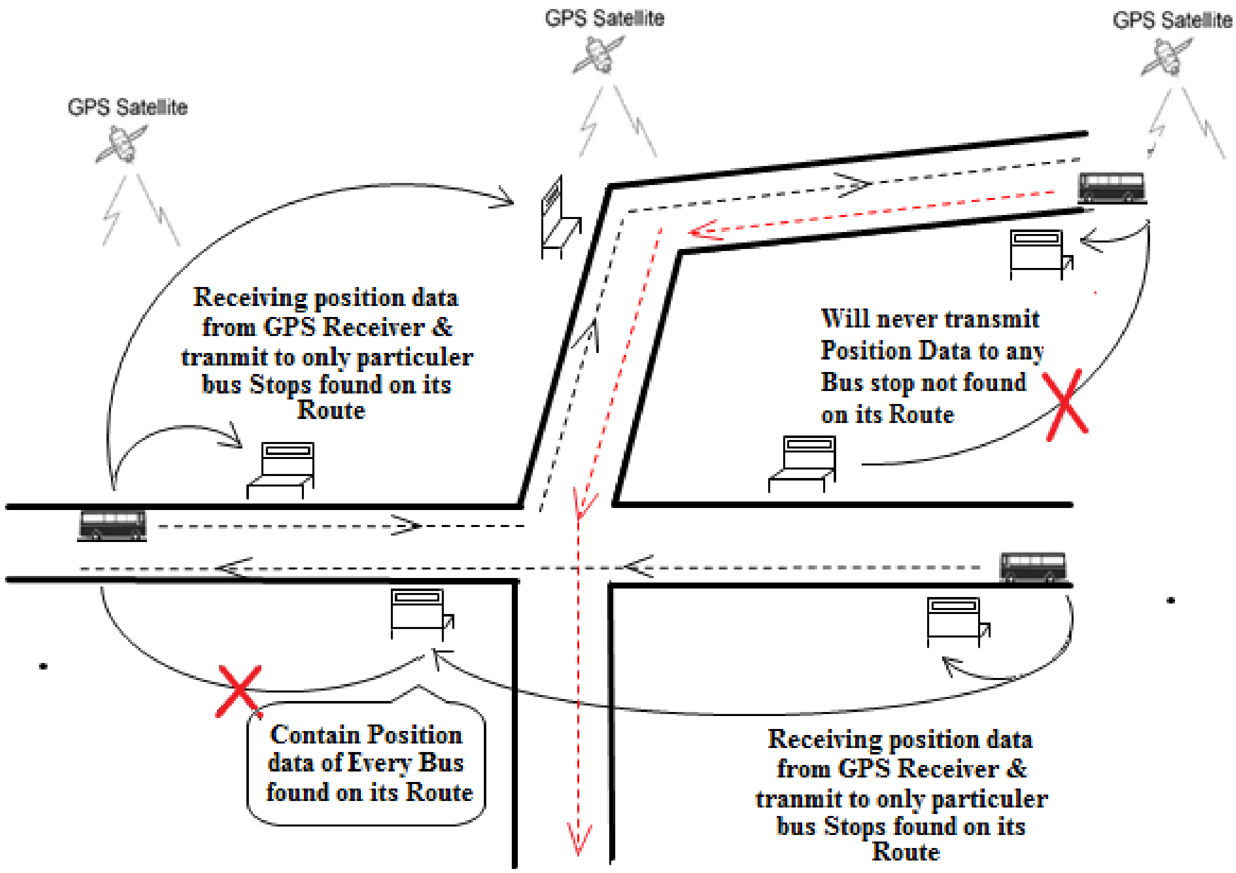

Figure 1. Proposed framework of concept.

keyboard information, like Bus unique ID, either UP or Down and time of departure. MCU will compare the bus position information received from GPS module with the station position information recorded in advance. In case matching, the advanced RF Module will be triggered as just a transmitter first corresponding actions (such as the display of position, time of departs and the special sign to recognize either the Bus is coming from which side) by the system. In a word, MCU is responsible for the control and management of the system. At the same time, it will connect the Slave parts wirelessly in order to transfer GPS data.

Slave module

The novelty of the study lies in the slave modules, which are is the critical section of presented paper. Several measures had been taken to send the Buses' location down to the specific bus station but due to numerous reasons growing day by day, most of them seem unable to provide reliable solutions to the suffered passengers. For the purpose, special algorithms are designed to operate the number of slave modules corresponding to the number of bus stations. These algorithms made this decision support system capable of holding the promise to overcome the lacks of past research, so the numbers of steps are described to facilitate the passengers waiting for the Bus. When the Bus (master module) is ready to move, after some data is input as described above, the master system will be configured as just a transmitter first and the nearest Bus Station (slave module 1) will be configured as a receiver first, so after login the system, the master module will receive the GPS signals for the Bus Location then after matching with the predefined coordinates being saved in the registers of MCU, will literally start to transmit to the first nearest Bus station. Now when the Bus is on the move, the slave module 1 will be configured as the transceiver and will send the Bus Position data to slave Module 2 (2nd next bus station) and up to so on. This chain for transmitting, receiving and displaying bus positioning information will be last until the final Bus station for every bus found in the particular route. Regarding display, the graphical liquid crystal display (LCD) is selected. The main concept is designed via core programming to provide maximum benefits to the passengers. The facilities contain the current position of total buses coming to the particular stop, even if any of bus found in between two bus stops, would be shown by the arrow in between the targeted stops with poles apart IDs. The described Figure 3 is the overall process flow of designed frame work. It mostly focused on the hardware implementation to support our proposed buses network monitoring and management system.

EXPERIMENTAL ANALYSIS

In order to implement the prescribed decision support system for the overall public transport network management system, this paper explores and identifies a unique design phase containing a system to mount GPS based embedded system on every Bus. The stand alone GPS containing system receives the raw signal and transmits

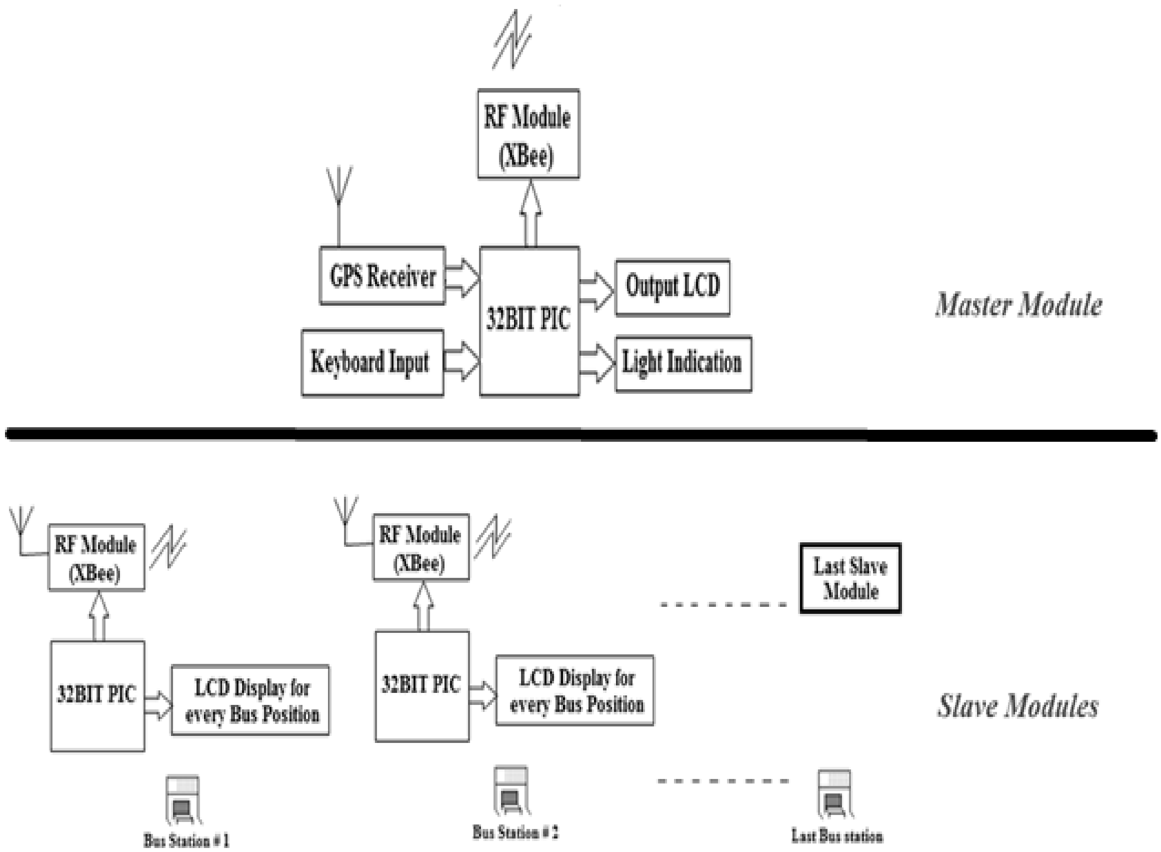

Figure 2. Integrated frameworks.

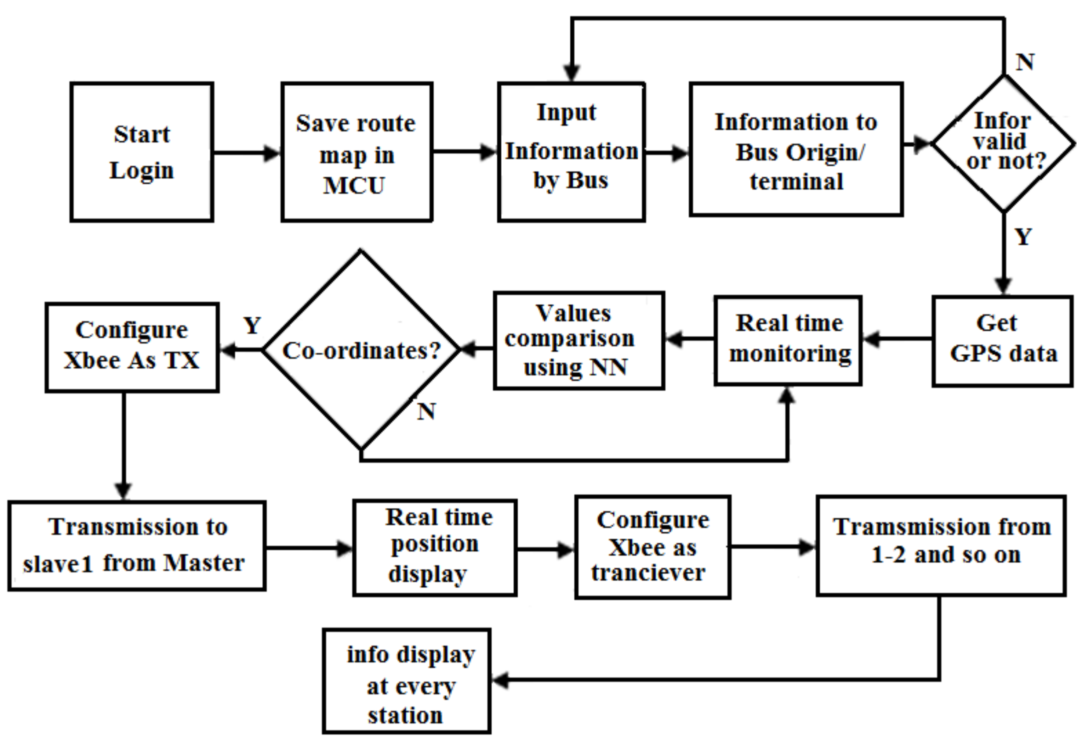

Figure 3. Process flow of frame work.

at the Bus Station by RF transceivers. These specially designed long range XStream RF Modules are efficiently configured to make sure a practical communication loop only found in the particular bus Route. To achieve best real time monitoring with finest and optimum results, several data sets of coordinates are collected from a selected bus route (B103). Each of the inputs and outputs are associated with a location within a predefined region of max 10Km diameter, since the area is likely being covered by the prescribed transceivers modules. Based on the circuit diagram, a mature prototype design is constructed and tested using collected coordinates. After utilizing pre configured transceiver modules, the transmission is checked on the small scale. The programming algorithm which is adopted to configure the master modules is generally described here. First the input data (by the driver) will be sent to first slave module then start collecting GPS data. Viod serTx (unsigned char); // for transceiver module connected to first UART// Viod serRx (unsigned int); // for GPS connected to second UART {Configure as a transmitter only; While (1) {serTx ('Unique ID of BUS'); // here ('B103') is taken.// } {Wait until transmitted} {Configure second UART as receiver only; //for receiving coordinates data } {Configure first UART to transmit only;//for transmitting location data to nearest slave module// } After receiving the particulars of Bus by the driver, every slave module is trained by the predefined ID of Bus found on its route. The matching of Unique bus ID is occurred. In case, matched, the GPS location data will be started to transmit to slave module 1 and so on till the last bus station found on the Bus route. When the master module (Bus) would reach at first slave module (Bus station), again matching process started but this time between trained coordinates at the master Module with the coordinates received by GPS. Selected digits from coordinates are allowed to match. In case, matched, this time the slave module will be configured as transceiver, receiving data from bus and sending to slave module 2 and so on.

This looping lasted till the final bus station. The National Marine Electronics Association (NMEA) message format analyzed here is the real coordinates of one of the station, which is received by the master module and after matching, send to as; $GPRMC, 161229.487, A, 0343.0366, N, 10307.1202, E, 0.13, 309.62 and 120598, *10. From the message, our major concerns are Navigation receiver warning (must be A), Latitude and Longitude. The programming algorithm, adopted to configure the slave modules is generally described here. Viod serTx(unsigned char); // for transceiver module only// Viod serRx (unsigned int); { Configure as receiver only; While(1) { serRx('Unique ID of BUS'); wait until received; { If (Unique ID is matched by pre defined ID) Configure Transceiver as receiver only; //to receive Location data from master module// Configure Transceiver as transmitter only; //to transmit Location data to next slave module// } The same programming algorithm is selected for every slave module when the particular Bus belongs to that module will reach at that bus station. Both modules were configured correctly to obtain the most efficient monitoring frame work. It can carry on the effective management to the public transportation vehicles in the most convenient way to the suffered passengers. It has many expandable functions, with considerable prospects for putting it on the market on the commercial basis. After testing and modifications the prototype for about half a year, the system tends to be much stable and capable of playing an important role in dispatching buses and commanding public transport network operations. With few workloads of processing, this technique is quite feasible. As for the future works, the focus will be on designing of centrally monitoring server based system by which the positioning data base of all the tracked vehicles could be examined. This would be help full of realizing the driver efficiency as well as the factors affecting on the well-organized monitoring system. For the purpose being, the magic of GSM technology will be suggested to utilize.

DISCUSSION

Operational effectiveness on methodology

The provision of services along different bus routes are used to specifically illustrate this framework with the understanding that modifications to the framework can be made to evaluate other modes of transportation. Like each local government may have a different purpose in establishing their own public transport monitoring system. In general, our proposed methodology can be summarized into four major reasons:

1.) Service improvement and provision of real-time information such as securing timeliness of bus operation and observation of allocation intervals to promote bus usage.
2.) Management improvement by just first time investment and increased profits, service improvement and reorganization of bus service structure.
3.) Setting the promotional policy for public transportation to respond to changes in the bus service industry.
4.) Real time monitoring with user friendly display will bring the increasing interest of passengers to the public transport network.

Based on the conceptual framework developed in this study, the overall performance and implementation for proposed paper at individual bus companies is determined by its organizational factors. A causal factor analysis model relating performance to organizational factors was established in order to identify the significance of this assumed relationship. By taking into consideration the some of the factors described below will surely increase the performance of implementation for the overall designed decision support system for the passengers. The effectiveness measurements of performance using the frame work on organizational factors are presented as follows.

Driver-defined factors

There are quite no. of driver-specific factor used in this study to make the system in the most implementable form. At the starting, some assumptions were announced for the better prospect of managing the whole monitoring system. Most of those assumptions were greatly utilized by the specific driver like just before starting the journey; he is restricted to have some input information about some parameters regarding the Bus. Beside this, taking some decision on some crucial stages to bring ease for the passengers as well as keep the average number of total traffic convictions while driving buses, specially prescribed by the regulators of the organization. This variable is employed to reflect the average driving record of each bus company. Parking violations are excluded due to their negligible influence on the overall monitoring and our route management framework. So the driver defined factor could be stated as the most effective factor to define the organizational behaviour of any bus company towards the adaptation of proposed system.

The vehicle-defined factors

Vehicles and relevant equipment are considered the technical factors affecting the managing performance of bus companies. The technical factors can make contribution to malfunctioning for overall monitoring system. Since in the proposed system for buses monitoring and route managing, the customized hardware is mounted on every bus and they were configured according to designed framework. For the purpose, two vehicle-specific measurements, GPS and transceiver, are considered in this study. In order to reduce the unwanted or negative effects on monitoring system, the suggested hardware is properly designed to fix on the selected buses to be monitor. Another factor is fleet age affects. First, new vehicles incorporate new technologies that improve safety as well performance. Second, new vehicles tend to have fewer failures in operation. Thus, the index variable (V1) measuring the proportion of vehicles aged and the installed equipment less than five years must be followed to reflect the fleet age. Vehicles aged less than five years are viewed as new vehicles by relevant traffic laws. The higher the proportion of new vehicles a bus company has, the fewer problems it will experience.

Overall management factors

The first general management factor considered is the ratio of driver to non driver staff, which represents the depth of support for a bus company. This framework is designed to promote the good effect of the organizational structure on the monitoring and management performance of bus companies. A higher ratio means each non-driver staff member or technical persons must support more drivers. A bus company with higher supporting ratio implies that its organizational structure is flat, and is expected to have a higher level of risk. Furthermore, the firm size, which is measured by the capital of a company, is another general management factor. The bus company with more capital is expected to have a better implementation of proposed methodology.

At last the factor, whose requirement varies depending on the community and its social awareness, is the preliminary awareness program to be conducted amongst the user and operators. This social consciousness program to train both the parties can greatly be utilize to make proper usage of the proposed integrated and customized hardware of overall system.

Conclusion

This paper presents Route Management of Public transportation services by the particular organization and the technological utilization in the wider aspect. Within multimode transit firms in the measurement of efficiency and effectiveness, the work raises a number of fundamental issues regarding the design of bus networks. Like in case decision support system, the generic needs of the user, such as updated information with reliability are well documented in the literature and are subsequently reinforced in this study. However, motivation and the socio psychological benefits associated with this form of transport facilities are not well researched. Second, the design of the framework impacts the fruitful investment in long term to the companies operating the services. The model is presented in Figure 1, illustrates several key stages which have to be taken into account by the transport planner. Anyhow, the approach will be enriched by taking into account ways to address the transport experience and by engaging the interest of many organizations in providing a network which offers travel integration. After testing prototype and modifications in the documentation for about half a year by taking extensive field test and surveys, the decision support system and proposed framework tends to be much stable and played an important role in dispatching buses and commanding public transit operations. With few workload of processing, this technique is quite feasible. Real time positioning and tracking technologies, which are integral to public transport network and their system management, can also contribute to quenching the thirst for data of the sophisticated, data-driven analytical techniques by providing an automated data collection and its position transmission means. As far as the future works concern, our focus will be on designing of centrally monitoring server based system by which the positioning data base of all the tracked vehicles could be examined. This would be help full to realize the driver efficiency as well as the factors effecting on well-organized monitoring system. For the purpose being, the magic of GSM technology will be suggested to utilize.

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