M2M Architecture for Enhancing Public Transportation Management Services Using ARM7

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Abstract:
Today's metropolis area suffers from constant traffic jams due to excessive use of private vehicles. Peoples normally use private vehicles because they don't have information about the correct arrival time of the public transportation such as buses, approximate seat availability in the buses, dynamic route changes of the buses etc. Therefore it is a great challenge to enhance the usability of the existing public transportation system instead of using private vehicles. Here the technology can play a significant role. An effective solution can be provided by establishing a wireless communication in the metropolis area. Moreover public transportation can be made more attractive by providing internet access to the passengers in public transportation. In this paper different approaches are studied upon in order to address the above stated problem.

Keyword: Public Transport, GPS, Wireless communication.

Introduction:

Today there is a rapid development of cities as well as their population is also increased in a rapid rate. It has a direct impact on public transportation system. Moreover the current public transportation systems are congested, unreliable, untimely and uncoordinated in the metropolitan areas. It increases the preference for using a huge number of private vehicles on the road. It is the result of constant traffic jam during the busy schedule of the day. The prime solution of this problem is to increase the popularity of public transportation. The idea of the Advanced Public Transportation System (APTS) has emerged using among other technologies communication network to provide more information to the users [1]. Normally the cellular (3G/4G) or IEEE 802.11 is used as communication network in the vehicular scenario, which improve the quality of services provided by public transportation system. The idea is to provide the information to the passengers about arrival time of the next bus of every bus line to each bus stop on the route. The bus route can be changed due to accident or roadwork. These route change information should also be considered. If these changes were ignored, the bus arrival time estimates would become useless. Therefore tracking of bus position and collecting of bus route changing information are the basic requirements to calculate the bus arrival time without significant error.

Global Positioning System (GPS) can be used for vehicle tracking. However using GPS requires an additional communication link to inform vehicle position. As an alternative, there are localization techniquesthat use network technologies [2], which can provide both services of locating a bus and sending the corresponding information to an access point. This potential has been explored even in simple proximity based localization systems. In such systems, the position of a vehicle is given by the position of the node the vehicle is connected to. Historical series collected even for months can also be used to estimate the bus arrival time [3]. Then, the estimate is calculated based on averages from the same period of time in the past. But, this method does not behave well in case of typical situations, such as accidents. In opposition to historical based approaches, in real time solution is assumed that the time taken by previous

vehicles in a given route is also the time next vehicles will spend [4]. Thus, only information from the same day is used, allowing this method to model unforeseen situations more efficiently. Kalman filter is also an approach to deal with problem but its performance is low well when location data are temporally sparse [5].

Providing Internet access to the passengers can be a solution as an alternative of using private vehicles. There are several choices of this purpose. Cellular networks may become sufficiently ubiquitous that individual passenger can use their own devices, such as smart phones or tablets. However, when mobile devices, specially tablets and laptop computers have only WLAN network capability and users do not want to use their cellular tethering services i.e. hotspot services, because of data usages capability; they cannot use the cellular network services.

Wireless router can be installed in public transportation in combination with cellular network interface and local WLAN network interface. But cellular network connectivity should exist throughout the route of vehicles in order to make this system efficient.

Public transport organization can install Wi-Fi access point at bus stations, allowing connectivity for passengers. However since such connectivity only lasts within limited network coverage of an access point, passengers experience intermittently connected network services. Despite this intermittent network services, the free or low cost nature of the services encourages passengers to use this Wi-Fi network. When passengers carry hand held mobile devices, equipped with WLAN interface, they can freely use Internet service without activating cellular data plan. This option is suitable for dense urban areas where the distance between stop is short. These intermittently connected networks suffer from resource limitations, especially short network connection periods and bandwidth limitations. When requests for content are not handled during a network connection period because the stopping time is not long enough, the pending request need to be queued until the next stop. This increase content retrieval delay. In addition, there is a flash crowd problem at the beginning of the network connection period because passengers try to access the network simultaneously when they get internet connectivity. These simultaneous attempts cause network connection problems that degrade link throughput.

Methodology:

At each bus stop there should be a screen for displaying several bus routes, the bus arrival time and the probable occupancy in the bus. So that the passengers can prepare for their journey. To establish the framework for intelligent transportation system every bus can transfer information to bus stop after reaching the bus stop, and bus stop transfers all information to control center which then sends the information to all relevant bus stops next on the route [6].

The steps are given below.

1. Reporting of the bus for a particular route will be done at bus stand (Central Server) and all the stops on that route will be informed about start of the journey. At the same time, Server will store the time at which reporting was done for further calculation.
2. When bus reaches the stop on concerned route (e.g. Stop 1 on Route 1), ticketing machine will send the information about the occupancy in the bus to the bus stop by using ZigBee communication.
3. The bus stop will forward the same information to the central server along with a time stamp (time of arrival).
4. The central server will analyze the information and calculate the arrival time and vacancies at all next stops and send the information to each stop.

5. All the stops, after receiving the information from the central server will update the display.

Another way to make people interested in using public transportation is to provide internet in the public vehicle. This facility can be provided through TCP/IP using wireless networks. Several web applications should be executed in the central server. Each vehicle

should equip with a computing node. More than one passenger can request for the same web content. It can cost for more bandwidth usages. To reduce the bandwidth usages the vehicle node can actively cache content and eliminate the retrieval of duplicate web content. In this system, which information is transmitted through wireless network with the help of web services for processing, monitoring and analyzing the data provide the control to the administrator and the people who use the system. By using this concept the people can monitor the travel duration and the position of the vehicle also.

The vehicle nodes can have two network interface cards operating on different channels. One for communication with passengers and the other communication with an access point at bus stop. So, there can be no single channel interferences between the two wireless links by using different channels, so the overall throughput of the two links increases. When the passenger does not have the requested contents in the local cache, and there is no Internet connectivity, existing HTTP caching proxies can return a failure, indicating that it has a network connection problem. Hence, clients need to retransmit the request. To overcome this problem queuing system can be applied. The vehicle node queues the requests and retrieves the requested content when it has internet connectivity so that the passengers can access the content from the vehicle node. Thus the vehicle node can work as a proxy server. The vehicle node creates multiple concurrent, parallel connections to web servers to retrieved contents when internet connectivity exists. If the vehicle node receives multiple requests for the same URL during a network disconnection period, it can aggregates the requests, retrieve the content from the Internet once and store the content in the cache. This aggregation can reduce bandwidth usages during network connection period [7].

It can also be possible to provide other similar type of cached content to passengers when their requested content is not available i.e. has not yet been cached. It may divert the passenger's interest to the cached content only and the passengers can be satisfied with the public vehicle's services until they are not getting the requested contents. The vehicle node must notify the passengers when their requested content is cached. The passengers does not need to manually checks for updates.

Conclusion:

Using of private vehicles is increasing in a rapid growth, which results in a constant traffic jam in a day to day life. In this paper, this problem is pointed out. Improved and trustworthy public transport services may lead to the solution of the mentioned problem. Setting up a coordinated smalldistance and long distance wireless communication network for public transportation, providing accurate information about the arrival time and seat vacancy in the public transportation as well as providing internet facility to the passengers can be the options for making the public transportation more usable and reliable.

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