ITS Feasibility Study for Public Transport in Slemani

by

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Introduction:

The invention of GPS and spreading cellular network widely has a significant impact on the development of transport management. One of the areas that has applied this type of technology is public transport especially buses which are not easy to predict the real time because of reasons such as; congestion, breakdowns and stopping time period. The main factors that make the public transport unattractive are waiting time and uncertainty in bus arrival (Ganesh, K., Thrivikraman, M., Kuri, J., Dagale, H., Sudhakar, G., & Sanyal, S., 2012).

A dramatic change is needed in operating methods for public transport to make it more usable. To achieve this, Intelligent Transport System is the most effective way by using the modern computer technology, mobile and Wi-Fi or GPRS. In order to make passengers able to have information about buses, lines, all stops and real-time, Intelligent Transport Information System should be implemented (Nagaraj, Wakade, Gaware, Dhame, & Alhat, 2011, p. 2635).

This essay will look at using Intelligent Transport System (ITS) application in public transport information system in Slemani. It will discuss the reasons for using this scheme in it with the implementation problems and also explain the potential benefits and costs.

Slemani is the city og the east of Kurdistan Region which is located in the northeast of Iraq; it has a population of 723,170 (Zakaria et al., 2013, p.1275).

Slemani has two main types of public transport; Bus and taxi. Both are not run by the government or companies but they are privately owned. In other words, bus drivers work for themselves and the government cannot intervene, in terms of when they

should run the service. As a consequence, buses working time depend on the driver decisions. Nevertheless, it is impossible to find buses after sunset (Hawzhen Rashadaddin, 2011).

Buses have significant problems such as inadequate terminals, bus stations, lack of modern buses and timetables. Most of the buses in the region are outdated which are uncomfortable and does not have air-conditioning. Despite hot weather in summer and no air-conditioning, buses wait for more passengers at terminals. It has a poor frequency which is different from developed countries. In other words, it stops at the terminal until the whole seats occupied and after that it moves to the destination. Moreover, there is no time table in the bus stops which means that no one knows that the bus come or not because it depends how long does it takes to make the bus full of passengers. The only alternative for bus is taxi which is four or five times more expensive than the bus. As a result, people have two choices, pay more charge to taxis or buy private cars which both have a negative impact on the level of congestions (Sleman Tashan, 2012).

As a consequence, it is really important to implement Transport Intelligent System (ITS) in bus information systems which attract more people in Slemani towards using buses. This leads to improve transport efficiency and encourage people to be more sustainable in travelling by using buses more and private car less, which have a great impact on reducing congestion and pollution.

There are different methods to use (ITS) in public transport information system and their working system are not exactly similar especially in terms of mobile applications. As it is mentioned by Ganesh, K. et al. 2012, Real –Time Passenger Information System (RTPIS) is one of the methods which has introduced a different kind of

technologies to find the location of buses in real time which is helpful to predict the arriving time of the bus along the route.

RTPIS helps passengers and tourists to take the best decisions about modes, routes and departure times. The framework of RTPIS has two main types: Pre-trip and On-trip context. The former obtains travel information before travelling such as; timing fares and routes, by using the internet or through the Short Messaging Service (SMS). The latter related to on the move circumstances which inform the passengers on board about location and places of interest (POI).

The application scenario of RTPIS is shown in Figure 1:

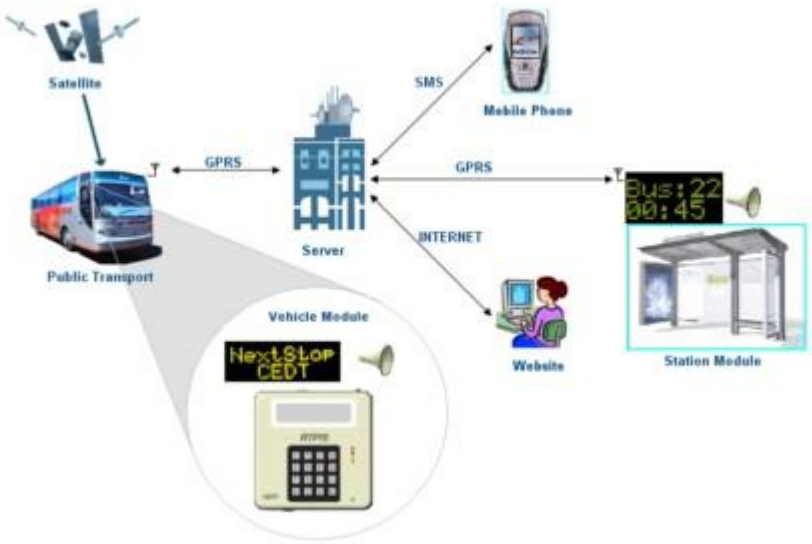

Figure 1 RTPIS Scenario (Ganesh, K. et al., 2012).

In order to implement the Real-time Passenger Information System (RTPIS), these parts are required: vehicle units which are buses, station units at bus stops and a server which works as centre for processing the data. The vehicle unit are related to

both Pre-trip context and On-trip context. In the former it is used to download the data about the stops and interested points from the server, but the latter is used to find the current information about the bus such as location, speed and direction which is transferred to the central server by GPRS and it also used to show “next stop/point of interest” data on board.

Block diagram of the vehicle unit is illustrated in Figure 2 and in Figure 2 photograph of the vehicle unit are shown.

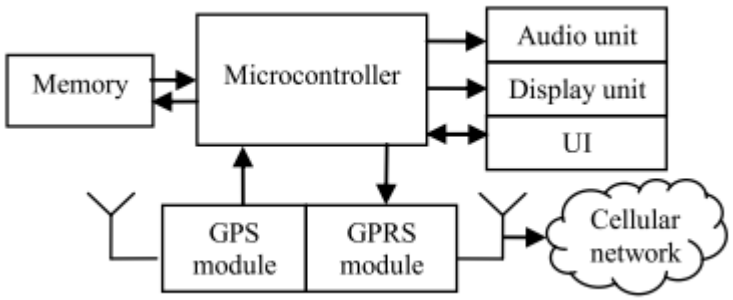

Figure 2 Vehicle unit Block Diagram (Ganesh, K. et al., 2012)

Figure 3 Photograph of vehicle unit (Ganesh, K. et al., 2012).

In the vehicle unit, the current location is computed by GPS receiver and this information with the speed of the bus is sent to the server by GPRS. From the server, vehicle units initially download the information about stops and POIs such as name and coordinates. This has the benefit of the passenger on board because it shows the stop name when it is reached. Bus drivers can use UI (keypad and display) for route changing, showing breakdown and finding a new route.

Another part of the system is the server which has fundamental roles such as: receiving information about all buses from the vehicle units regularly, keeping a database updated, which is shown in (Table 1), measuring the Estimated Time of Arrival (ETA) for all the buses the bus stops before arriving, activating Internet web pages which help passengers to find buses in real time by showing maps of any routes and providing plan trips.

Table name	Contents
Bus	Bus ID, type and route
Bus Position	Bus ID, current coordinates, speed, average speed, direction, current link, link entry time, estimated end time, status
Bus Position Log	Log of changes made to bus position table
Node	Node ID, coordinates, name
Link	Link ID, node pair, travel time
Route	Route number, sequence of links
Stop	Stop name, node ID, route number, ETA

Table 1 : Database Tables (Ganesh, K. et al., 2012).

Station unit which is part of the server has some duties such as: providing ETA for all routes and showing the ETA at the stops. It can be seen from Figure 5, that the architecture of the station has the same characteristic of the vehicle unit, apart from the GPS and the UI.

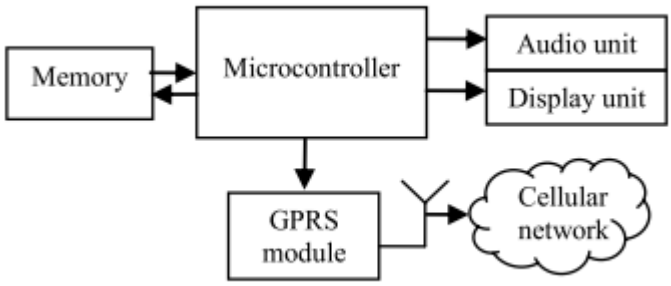

Figure 4 Station unit Block Diagram (Ganesh, K. et al., 2012).

The fundamental benefit in any RTPIS system is arrival time forecasting. Although ETA can be forecasted infinitely for the potential journey, the forecasted ETA at bus stops is restricted by the maximum limit of one round trip time of the route. The ETA algorithm is divided into Link updater and ETA calculator. The former computes the journey time for each link, but the latter is used to find the ETA for any bus stop.

The development of the Internet has a significant benefit to online users by helping them to obtain information about their travelling. The RTPIS website provides travel information for passengers before travelling such as current location of buses, real time information and route map. Passengers can use the web page to join the origin and destination stops. This is done by using Trip Planner which makes passengers to be able to organize and plan their trips ahead through discovering the routes that are common to the origin and destination stops. After that, it selects the forecasted ETA

that is nearest to the desired time. Also, the web page allows passengers at a bus stop to know ETA for these routes that pass it and it provides the route map for any chosen route through showing all paths and stops across the route. This is done by the Google maps Application Program Interface (API) which is illustrated in Figure (5). Moreover by using web page, passengers are able to choose any route and see the current location of all buses on the route map which is provided by finding the location of all buses of a route through database and drawing it on the map (Ganesh, K. et al., 2012)

Figure 5 Route map overlaid on Google maps (Ganesh, K. et al., 2012).

As it mentioned in Watkins, et al., 2011 “One inexpensive way to combat the perception of unreliability from the user perspective is real-time transit information”. This system has low cost and inexpensive because it does not need to build any new infrastructures. The bus, bus stop and the bus stations are already existed. It needs to erect electronic information sign, GPS receiver on the bus and mobile application.

The most expensive part of this system might be information sign at bus stop. The Digital sign service costs £240 each year which this amount of money covers the initial set up, supply and configuration for one bus stop. Also it covers the lifetime costs for the management of stops within the display (Transport for London, 2011).

Using (ITS) in public information system especially bus improves transport efficiency and it has significant benefits to passengers. As Watkins et al., found that passengers who use real-time information have no longer perceived wait time than measured wait time. However, passengers without real-time information perceive their wait time to be higher than measured wait time. By having the real-time information, passengers perceived wait time is reduced by 0.7 min (approximately 13%). Also, Watkins et al. discovered that mobile real-time information decreases passengers' actual wait time which they wait approximately 2 min less than passengers arriving using traditional information system. This is because mobile real-time information makes the passengers to be able to have information before they reach the bus stop (Watkins et al. 2011, p.839).

Furthermore, Vanajakshi L. et al. stated that the most effective way to encourage people using public transport is achieved by providing them real-time information about bus arrivals. When passengers have these instructions either by wired or wireless media, they can organize their time more effectively by less waiting time at bus stop and having alternate plan if the bus is postponed. This will attract more people to use public transport which means that less using private cars, decreasing traffic congestion and pollution (Vanajakshi L. et al., 2009, p.1).

There are some issues arise when this system is tried to implement in Slemani such as physical and technician issues. Some of buses are out of date which is difficult to

set up GPS receiver on it and not easy to connect to the server. The buses are personally owned which means that they are not owned by one organization. This leads to have a difficulty to implement the ITS which need one organization to set up and pay for it. However, Government should overcome the mentioned barriers in terms of ownership and administration and think about this type of systems with buses which is cheaper than any other type of transport solutions such as tram and metro.

Conclusion:

Intelligent Transport System using in public transport information system attracts passenger to use public transport and improves transport efficiency by providing real-time information about the buses before arriving the bus stops. This helps decreasing waiting time, improving the perception of the wait and easing the stress of uncertainty before the bus coming. Real –Time Passenger Information System (RTPIS) has significant impact on travelling by predicting the arriving time of the bus along the route. By using this system passengers can obtain travel information before travelling and when they are on board. Vehicle units which are Buses, station unit at bus stops and a server are needed to implement Real-Time Passenger Information System.

This system has enormous benefits for these cities that have congestion and pollution problems by encouraging people to use public transport. Slemani has both congestion and pollution issues. As a consequence, it is a good idea to introduce this system. However, there are some barriers faced the implementation process such as: the ownership of the buses which are not owned by one organization but owned as personally based and most of the buses are out-dated. If the government wants to attract more people towards using public transport which is the best and cheapest way to solve the congestion and pollution problems, it is better to overcome these barriers and implement this system as soon as possible.

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