Australian Journal of Basic and Applied Sciences, 6(13): 181-184, 2012
ISSN 1991-8178

Bus Scheduling Model User Interface

Amiruddin Ismail, Mohammad Hesam Hafezi, Foad Shokri, Mojtaba Shojaei Baghini and Mohammad Ganji

Sustainable Urban Transport Research Centre (SUTRA)/, Department of Civil and Structural Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor Darul Ehsan, Malaysia

Abstract: Bus schedules consist of different values of time and space in which each value can affect other values. In other words, bus scheduling is a network of numbers and parameters for obtaining planning output, which is very complex. Bus schedules can be prepared by two ways: manually which is based on trial and error and using the computer system. With the growth of computer technology, most transportation authorities tend to use this technology in the planning of bus schedules, for reasons of scope and convenience. In the meantime, organizations the input and output data on bus schedule is considered as a necessary part of preparing the scheduling which it can achieve through data mining in terms of classification approach. Data mining is the process that results in the discovery of new patterns in large data sets. It utilizes methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The overall goal of the data mining process is to extract knowledge from an existing data set and transform it into a human-understandable structure for further use. This article represents a new bus scheduling technique, which the data are organized as a data mining approach.

Key words: Bus Schedule, Timetable, Data mining, Frequency, Demand of passengers.

INTRODUCTION

In developing countries, demand for passenger travel is higher, due to economic growth. In some cases people come from suburban areas to the central business district in the morning and return to their hometown after working. Also, a large number of intercity trips are made. In this situation, government policy encourages people to use public transportation instead of their private cars for the reduction of traffic congestion and air pollution. In the city areas, bus networks are the major part of the public transportation system because they are easily accessible and cheaper compared to other types of public transportation (Ismail and Hafezi 2011). Data mining is one of the concepts which by utilizing it we can isolate significant data with unimportant data and discover hidden data relations. By using data mining techniques, we will be able to detect useful data and to use them in queries so we can enhance the speed of information accessibility (Hafezi and Ismail 2011a). Data mining support knowledge discovery by finding hidden patterns and associations, constructing analytical models, performing classification and prediction (Hafezi and Ismail 2011b). The most common tasks in data mining are Classification, Clustering, Association Rules and regression.

Classification is used as a general purpose task in Data Mining. Similar attributes are allocated in a specific class. Model defining is essential for using classification. Classification used supervised algorithms such as Decision Trees, K-Nearest Neighbor, Naïve Bayes, Neural Networks and support vector. One of the widely used tasks in data mining is clustering. Clustering as a data mining task is also called segmentation. It is used for identifying natural groups of data based on attribute specifications. Each group consists similar attributes.

Clustering is an unsupervised method. Thus, it doesn't use attributes for learning. Iteration has an important role in clustering methods for converging of the model. In Association Rules tasks pattern repetition is important. Data categories are defined by using this task. Some methods based on Association rules are CBA, CPAR and CMAR. Regression is used for forecasting. Variables are divided to Independent-Predictor and Dependent-Response types of regression oriented tasks. Regression tasks forecast Dependent-Response variable by using Independent-Predictor variables (Han and Kamber 2006). In this paper, we present a bus schedule model by considering data mining method.

Bus Scheduling Techniques:

Bus schedules can be prepared by two ways: manually which is based on trial and error and using the computer system. Bus schedules consist of different values of time and space in which each value can affect other values. In other words, bus scheduling is a network of numbers and parameters for obtaining planning output, which is very complex (Hafezi and Ismail 2011c). With the growth of computer technology, most

Corresponding Author: Mohammad Hesam Hafezi is currently a research scholar in Civil and Structural Engineering, Universiti Kebangsaan Malaysia (The National University of Malaysia).
E-mail: hafezi23@eng.ukm.my, Hp.: +60122127981

transportation authorities tend to use this technology in the planning of bus schedules, for reasons of scope and convenience (Hafezi and Ismail 2011d).

Furthermore, with the development of the Smartphone (mobile phone which incorporates a palmtop computer or PDA) technology, the output of computer bus scheduling can convert to an application that can be installed in the Smartphone, which allows the user to find details of bus operations, such as location of bus stops, bus route and arrival times ((Hafezi and Ismail 2012). Computer programming is composed of a programming language, which is an artificial language designed to communicate instructions to a computer. Computer programming can be used to create programs and planning based on precisely designed algorithms. There are different systems on the market for preparing timetables, such as Trapeze, Hastus, MICROBUS or Mobile-Plan. Two popular programming languages that most bus companies use for preparing a computer bus scheduling are: Java Script and Visual Basic (Ford 1990).

Java Script (Java) is a general-purpose, concurrent, class-based, object-oriented language that is specifically designed to have as few implementation dependencies as possible. Java programming is most used for offline computer bus scheduling, for calculating the requirements of bus operation, such as fleet size, headway and bus frequency. iBus-Vancouver has prepared a computer bus scheduling that shows the whole-day schedule for any day of the week (City-Go-Round 2012). Furthermore, this computer bus scheduling is able to show all the bus lines in the bus network throughout the city (Hafezi *et al*.2012). Bus companies also use Java for preparing timetables for both bus drivers and passengers, which can be obtained by connecting to fundamental bus scheduling (fleet size, headway and bus frequency).

Visual Basic (VB) is one of the most popular programming languages for preparing computer bus scheduling. VB provides a graphical user interface (GUI) that allows the developer to drag and drop objects into the program as well as manually write program code. Furthermore, VB is able to connect with a map, so that by clicking on each point on the map, information on that point can be shown. Buzz Stop is the name of a computer bus scheduling tool prepared by Boston Bus Company in the US. This program has assisted in the construction of the VB (City-Go-Round 2012). Buzz stop consists of an offline map with accurate coordinate and orientation system. Thus, users are able to select their destination point on the map and program help for finding the available bus lines, with guidance from the directions to indicate the nearest bus stop (for example: 200 meters to the left, then 50 meters to the right).

Recently, the United Bus Company of Tehran prepared an application for their users, by which they are able to find the different ways to arrive at their destination. Furthermore, this application is also connected to the Metro network, which enables users to choose mixed transportation types for travelling to their destination point. TDCS is prepared for a major bus line (route 7D) in the Ontario, Canada, starting from the Transportation Center (TC), via the University of Waterloo and back to the TC terminal. Their computer bus scheduling consisted of three major parts, namely, bus statistics, including information about total buses, average total travel time, total trip and average seat rate; passenger statistics, including information about the average waiting time and average in-vehicle time; and route information, including information about route No., total stops and distance.

Most of the computer bus scheduling tools presented are based on user interface (travel client), tracking of buses in the network, and showing the bus stop and the bus line in maps including the arrival time. However, this bus scheduling software cannot be used for implementation of different scenarios incorporating changes for improving bus services (travel server). For example, total passenger demand for using the bus line has a direct effect on the calculation of the fleet size and bus frequency. Furthermore, most of the functional objectives related to bus operation, such as optimization of bus stop spacing, optimization of operating cost, and improving the fleet size and trip time, are based on mathematical software such as: Matlab, Maple and Matcom. As a mentioned above, bus scheduling is a network of numbers and parameters in which all of the operate together. Using an Excel program with Visual Basic can help to prepare a better application that works with a large number of values, such as timetable in bus operation, and the departure time of flights in airport services. The Excel program consists of unlimited cells, where each cell can take a formula and instruction. Also, Excel is able to give an output of all the programming lines written. Furthermore, Visual Basic with a graphical user interface (GUI) such as a button or a check box, can help to create user friendly software, since GUI buttons are easy to understand (users can see them and interact with them directly) (Larsen 2008).

The Model User Interface: Bsm:

Bus schedules model (BSM) in this present study is provided by a computer programming that it is able to providing the details of bus planning such as: arrival time, departure time, dwell time and buses headway. Computer programming is consisted of two parts including BSM server windows that let the operator to change the database and properties and BSM client windows that help the users to access to the client part more easily.

BSM Server Windows

Figure 1 shows the user interface of the BSM server windows. This window contains of adjustment tools that help the operator to adjust the schedule model to the ideal condition. The BSM server windows contain route information, bus statistics, passenger statistics and schedule. In the part of rout information, the operator is able to choose the zone, bus line number (according to selected zone), direction (inbound or outbound), operation time (morning rush traffic period; evening rush traffic period and other times). Then, the values of headway, total stop and bus stop spacing are shown according to data chosen. In the part of bus and passenger statistics, the operator is able to monitor and adjust the schedule model according to current operation time and selected scenarios in the schedule section. Information on fleet size, average journey time, bus speed and type, average waiting time, demand of passenger and load factor is shown for selected scenario. Finally, in the part of the schedule, the operator is able to examine the different scenarios and subsequently prepare the schedule model by clicking the display schedule button and shift to Excel file. In this part the operator is also able to see the selected bus line map by clicking the display map button. In this case the operator can print out the map page by clicking the print button.

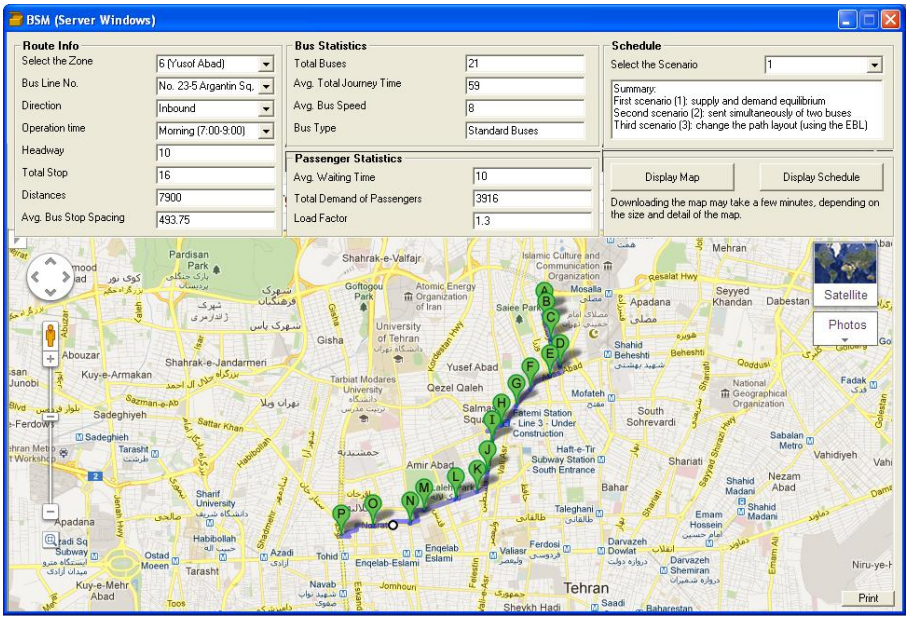

Fig. 1. BSM server windows

BSM Client Windows:

Figure 2 shows the user interface of the BSM client windows. The BSM client window is a downloadable file that the user is able to download from the internet (bus company website) and run on a personal computer. This window contains route information and schedule. In the part of route information, the schedule model gives the option to the users to choose the zone and subsequently bus line. Also, the user is able to choose the direction. The display schedule and map buttons are used to show the timetable and bus line map. To provide better conditions for the user, the schedule is illustrated in a small table in the window. Furthermore, the schedule is shown for the half hour interval time before and after the current time. Also, the user can print out the schedule and map by clicking the print buttons, which allows the user to bring the schedule and map to guide them when they don't have access to a computer.

Conclusions:

The main contribution of this study was helped to the Bus Companies for providing the regular planning for their services. This bus scheduling model cans implementation in other places that the authorities want to improve their services. Some effective parameters should be changed in the computer planning such as boarding and alighting time if in the places behavior of passengers including male and female were different and they used separated section inside the buses. By the computer planning presented in this study Bus Company authorities can provide a strong timetable for different time duration bus operation. Furthermore, they are able to balancing between capabilities and shortcomings by examination them into the computer planning. To adapt the model to a different bus line involves the following steps: first, to construct the route in the model, information

on the schedule and route layout are necessary, and second, to calibrate the model, data is needed for the segment running time, key stop dwell time, terminal departure behavior, and passenger demand.

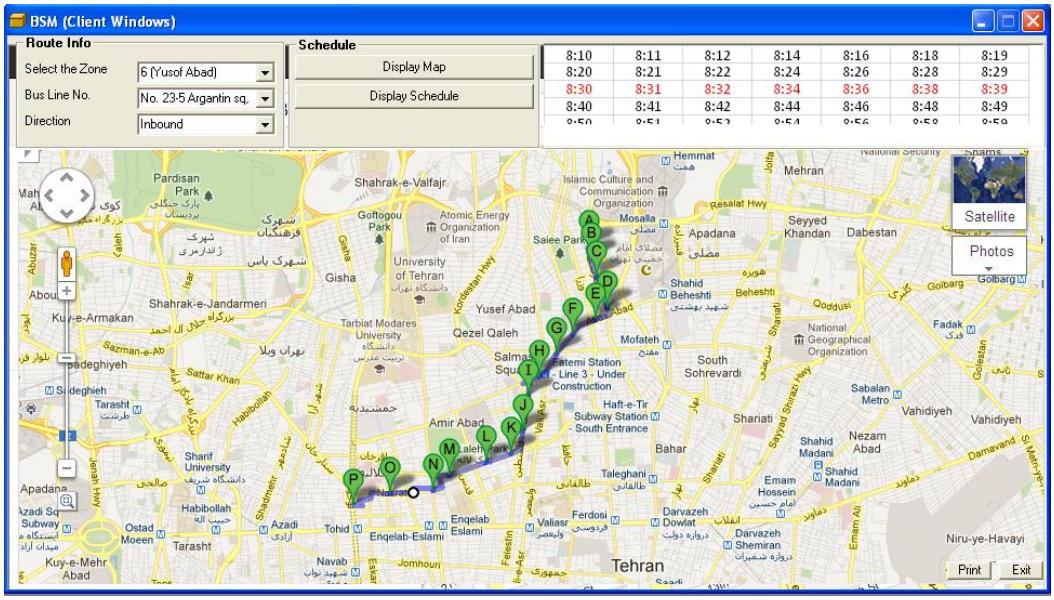

Fig. 2: BSM client windows

REFERENCES

City-Go-Round, 2012. http://citygoround.org/apps/.

Ford, N.J., 1990. Computer programming languages: a comparative introduction. Chicago Illinois: Horwood.

Hafezi, M.H. and A. Ismail, 2011a. Interaction between Bus Stops Location and Traffic on Bus Operation. Applied Mechanics and Materials 97-98: 1185-1188.; DOI: 10.4028/www.scientific.net/AMM.97-98.1185;

Hafezi, M.H. and A. Ismail, 2011b. Balancing Between Headway and Frequency Scheduling for Bus Service. Applied Mechanics and Materials 97-98: 669-673.; DOI: 10.4028/www.scientific.net/AMM.97-98.669;

Hafezi, M.H. and A. Ismail, 2011c. Bus Scheduling Model for Adjustment Headway of Bus Carriers. Applied Mechanics and Materials 97-98: 911-915. .DOI: 10.4028/www.scientific.net/AMM.97-98.911;

Hafezi, M.H. and A. Ismail, 2011d. Study Behaviour of Passengers on Transit Operation. Applied Mechanics and Materials 97-98: 1154-1157. DOI: 10.4028/www.scientific.net/AMM.97-98.1154;

Hafezi, M.H., and A. Ismail, 2012. A Comparative Analysis of Fare Collection System on Bus Operations, Journal of Applied Sciences, 12(4): 393-397.

Hafezi, M.H., A. Ismail, R.A. Al-Mansob and Omran Kohzadi Seifabad, 2012. Comparative Analysis on Bus Operation Duration Light and Rush Traffic Period. International Journal of Engineering and Technology, 4(1): 97-102.

Han, J. and M. Kamber, 2006. Data Mining: Concepts and Techniques. 2nd ed., University of Illinois at Urbana-Champaign.

Ismail, A. and M.H. Hafezi, 2011. Analyzing of bus operation to obtain regular frequency for neo-mission, Australian Journal of Basic and Applied Sciences, 5(11): 1275-1284.

Larsen, R.W., 2008. Engineering with Excel. New Jersey: Pearson Prentice Hall.