MALAYSIA NETWORK TRANSIT ROUTE ADVISER SYSTEM

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ABSTRACT

Malaysia has been developed from one stage to another stage. By looking at the transportation in Malaysia, there are about too many types of transport that are commonly used either private or public such as car and bus. One of the transports which now days got attention from the public is transit such as KTM Commuter, Express Rail Link (ERL), KL Monorail, Putra LRT and STAR LRT. Most people like to use this type of transport because to avoid from traffic congestion on the road or to choose the easiest method to move from one destination to another. Nevertheless, these transit also facing with a lot of problems including the customer satisfaction and delay of train. Anyhow, the customer always faces difficulty to find the shortest route. Failed to do so the cost will be increased according to the route chosen and the time is not accurate. This is because there are too many option of route to go to each destination. This problem comes when users need to change from one train to another train to reach the destination. Until now Malaysia has five type of transit that is often used. Malaysian Network Transit Route Advisor (MANTRA) is a web based system that especially developed to guide the people when using the Malaysian Transit. MANTRA has two main functions. The first is to estimate the lowest cost base on time travelling from one station to another and the second function is estimate the lowest cost base on the ticket price. MANTRA using Dijkstra's Algorithm to realize these functions. MANTRA 98% successfully to advice the tourist goes to the destination using Malaysia Transit.

ABSTRAK

Malaysia telah berkembang dari satu tahap ke tahap. Melihat kepada pengangkutan di Malaysia, ada terlalu banyak jenis pengangkutan digunakan baik swasta mahupun awam seperti kereta dan bas. Salah satu pengangkutan yang sekarang ini mendapat perhatian dari masyarakat adalah transit seperti KTM Komuter, Express Rail Link (ERL), KL Monorail, Putra LRT dan Star LRT. Kebanyakan orang ingin menggunakan pengangkutan awam kerana dapat mengelakkan daripada kesesakan lalu lintas di jalan atau untuk memilih cara paling mudah untuk pergi dari satu tempat ke suatu tempat tujuan yang lain. Namun demikian, transit ini juga menghadapi banyak masalah termasuk kepuasan pelanggan dan kelewatan. Bagaimanapun, pelanggan selalu menghadapi kesulitan untuk mencari laluan yang paling singkat untuk ke destinasi.Gagal untuk melakukanya kos akan meningkat jika laluan yang dipilih dan masa tidak tepat. Hal ini kerana ada terlalu banyak pilihan laluan untuk pergi ke destinasi masing-masing. Masalah ini muncul ketika pengguna harus menukar dari satu stesen ke stesen lain untuk sampai ke destinasi yang dituju. Sampai saat ini Malaysia memiliki lima jenis transit yang sering digunakan. Rangkaian Malaysia Transit Route Advisor (MANTRA) adalah sistem berasaskan web yang khusus dikembangkan untuk membantu penguna ketika menggunakan Transit Malaysia. MANTRA memiliki dua fungsi utama. Yang pertama adalah untuk menganggarkan kos terendah untuk waktu perjalanan dari satu stesen ke stesen yang lain dan fungsi kedua adalah menganggarkan kos terendah untuk harga tiket. MANTRA menggunakan Algoritma Dijkstra untuk menjalankan fungsi-fungsi ini. MANTRA 98% berjaya untuk memberikan cadangan kepada pelancong untuk pergi ke destinasi mereka menggunakan Malaysia Transit.

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ABBREVIATION

SDLC	System Development Life Cycle
RIP	Routing Information Protocol
OSPF	Open Shortest Path First
EIGRP	Enhanced Interior Gateway Routing Protocol
IGRP	Interior Gateway Routing Protocol

CHAPTER 1

INTRODUCTION

This chapter will provide a brief overview of the entire project including the objective of the project, scope, problem statement and organization of the thesis.

1.1 Introduction

Malaysia Network Transit Route Adviser (MANTRA) is a web based system that develop specifically for Malaysia Transit Network to advise the tourist journey using Malaysia Transit. Current practice use manual process to identify the information about Malaysia Transit. This system was is an upgrade from manual process to electronic process.

To overcome the problem, MANTRA provide some feature to help tourist planning the journey better, the idea of this system is to advise the tourist to find the best way via the system. The system allows tourist to know the condition of the journey using Malaysia Transit Network.

This system is a web based application using html and jsp language and Netbeans 6.8 to develop the system. The system will interact with a single enterprise database thought My SQL.

1.2 Problem Statement

Currently, for a tourist who wants to travel using Malaysia Transit, need to use through the manual method, firstly the tourist must find the Malaysia transit network map. After that the tourist must do some research to find the best way for traveling using Malaysia Transit. The Tourist must estimate and calculate the cost traveling manually. Lastly from the information the tourist will plan the travel using Malaysia Transit.

Using the manual method the tourist has to store all information in a files or a note. If a tourist wants to search the information, that tourist has to go to the train station and check it manually. This complicates the tourist to search the information manually where as it there was a computerized system, Tourist don't have to do it manually.

1.3 Objective

i. To develop Malaysia Network Transit Route Adviser.
ii. To estimate shortest route part and traveling cost.
iii. To implement kiosk application for Malaysia Network Transit Route Adviser.

1.4 Scope

Basically, Malaysia Transit Network Route Adviser systems focus on:

i. Malaysia Network Transit Route Adviser System is an application, which is developed specifically for tourist to plan the best way for their journey on Malaysia Transit Network.

ii. Two user can use this system:

   a. Tourist

      i. Used by tourist to find the best way for the traveling.

      ii. Estimate traveling cost using Malaysia Transit Network.

   b. Admin

      i. Make the analysis for route path and traveling cost.

iii. Web based Application

   The system consists of two modules, Tourist module and Admin module. They must use the web based application to run the system.

1.5 Organization of the Thesis

This thesis consists of six (6) chapters. Chapter 1 will provide a brief overview of the entire project include objective of the project, scope and problem statement.

In Chapter 2 briefly explains about manual process of the MANTRA and background of the project studied. The other aspects that will be discussed include comparison with the similar existing application. The methodology used for developing the application will be provided.

Chapter 3 also details out the system development life cycle besides software and hardware specification that are needed for this project development.

Chapter 4 explains about implementations that are required to develop the system.

Chapter 5 will describes output of the MANTRA System, constrains in completing the project, result and recommendations for further research of the system.

Chapter 6 is about consisting of five chapters which each chapter describes the process in developing the project.

CHAPTER 2

LITERATURE REVIEW

This chapter briefly explains about the manual process of transit network in Malaysia and background of the project studied is stated. The other aspects that will be discussed include comparison with the similar existing applications.

2.1 Introduction

The need for Kuala Lumpur's public transport system to be revamped became apparent almost immediately after the LRT lines began commercial operations when their ridership was much lower than anticipated. This caused lower than expected revenue levels and the two LRT concessionaires, System Transit Aliran Ringan Sdn Bhd (Star-LRT) and Project Usahasama Transit Ringan Automatik Sdn Bhd (Putra-LRT), could not repay their commercial loans. The financial crisis of 1997/1998 aggravated the situation. The two companies owed a total of RM5.7bil as at November 2001 when the government's Corporate Debt Restructuring Committee (CDRC) restructured the debts of the two LRT companies.

As congestion in large urban areas continues to worsen and gas prices began to rise in the recent years, the attractiveness of public transit as an alternative to private cars has also been growing. However, for a public transit system to help meet the growing travel demand and alleviate the congestion problem, it must be able to provide reasonable travel time and convenience relative to private vehicles. Travel time and convenience are affected directly by the configuration of a transit network (TN) and service frequency, although other service and traffic characteristics and pedestrian environment will also have an impact on the willingness of the public to use transit.

The quality of a TN may be evaluated in terms of a number of parameters including route directness, service coverage, operator cost, transit user cost (including waiting, in-vehicle, and transfer times), and the average number of transfers required to accomplish a trip. Route directness may be measured by the additional travel time incurred to a transit user when a bus does not follow the most direct route between the user's origin and destination. Service coverage refers to the percentage of total estimated demand (i.e., transit trips) that may be potentially satisfied by the transit services provided, based on a given transit route network. Operator cost is the cost to a transit property to provide transit services within a given network. Transfers are a result of not being able to provide direct services between all pairs of origins and destinations.

2.2 Overview of the Conventional System

As time goes, Malaysia has been developed from one stage to another stage. Looking for the transportation in Malaysia, There about too many types of transport that are commonly used either private or public such as car and bus. One of the transports which now days got attention from the public is train. Most people like to use this kind of transport is because to run away from get stuck on the road or to choose the easiest method to move from one destination to another destination. Nevertheless, train also facing with much of problems right now. The problems are difficulty to find the simplest route, the cost will be increased according to the route chosen and the time is not accurate.

This is because there to many option of route to go to each destination. Why it is happen? This problem comes when users need to change from one train to another train to reach the destination. Until now Malaysia has five type of transit that is often used which are KL Monorail, STAR line, PUTRA line, ERL and KTM Komuter. According to all of the transit, about eight of them are being as interchange stations.

The second problem is the cost will be increased according to the route chosen. The reason is there is no any guideline to choose the simplest way to reach the final destination. Besides that the range of the ticket price for each transit is quite different. For example if someone wants to go to Masjid Jamek from Serdang they actually have to option of route to choose. First, they need to get a ticket of KTM Komuter train from Serdang to KL Sentral and interchange to Putra LRT from KL Sentral to Masjid Jamek. The ticket price from Serdang to KL Sentral is RM1.70 and from KL Sentral to Masjid Jamek is RM 1.30. The total amount of this journey is RM3.00. The second option is by taking a KTM Komuter ticket from Serdang to Bandar Tasik Selatan and interchange to Putra LRT from Bandar Tasik Selatan to Masjid Jamek. The price for the ticket from Serdang to Bandar Tasik Selatan is RM1.00 and from Bandar Tasik Selatan to Masjid Jamek is RM1.70. The total amount of this journey is RM2.70. Base on comparison above, this show that journey taken by anyone is not the same even though they are looking for the same destination. The price will be increased when someone did not know the price for each route and usually whoever that is not familiar with this kind of transport. They will choose to interchange to another transit at the famous station for their safety which is KL Sentral although their costing will be increase. They worried to interchange at others station because of no any guideline for this journey.

Other than that, time accuracy being a factor that contributes in the train problems. Sometime, the trains always delay and this will change the schedule. Beside that the train also getting full and people have to squeeze with each other when the train is delay. Therefore this situation provides uncomfortable. Perhaps, someone might be choose wrong way or stop at the wrong station in order to find their route to go to the destination. They finally have to wait again for another train to back to the right station and all of these matters implicate a lot of wasting time.

Putting it in the nutshell, there are a lot of changes needed in order to improve the quality of this type of transport. Train now being a very important transport for the people who need to be fast and save their money. We can ensure that one they train will be the first choice of public transport for the people if the service gets improvement from time to time. People can reach their destination in a very precise time and the schedule will not be disturbed, people now their own route and never waste their money for unbeneficial payment anymore.

2.3 Studies of Existing Systems

There is having some example of computerized system that has built like New Parallel Shortest Path Searching Algorithm based on Dynamically Reconfigurable Processor DAPDNA-2, Decision Making Strategies for Intelligent Control system of Train Speed & Train Dispatch in Iran Railway and Least-Cost Path in Public Transportation Systems with Fare Rebates that are Path-and Time-Dependent. These systems build with same purpose that is for changing from manual to practical system and easy to analyze data of the system.

2.3.1 New Parallel Shortest Path Searching Algorithm based on Dynamically Reconfigurable Processor DAPDNA-2

This paper proposes a parallel shortest path searching algorithm and implements it on a newly structured parallel reconfigurable processor, DAPDNA-2 (IPFlex Inc). Routing determines the shortest paths from the source to the ultimate destination through intermediate nodes [1].

In Open Shortest Path First (OSPF), Dijkstra's shortest path algorithm, which is the conventional one, finds the shortest paths from the source on a program counter-based processor. The calculation time for Dijkstra's algorithm is $O(N2)$ when the number of nodes is N. When the network scale is large, calculation time required by Dijkstra's algorithm increases rapidly. It's very difficult to compute Dijkstra's algorithm in parallel because of the need for previous calculation results, so Dijkstra's algorithm is unsuitable for parallel processors.

Our proposed scheme finds the shortest paths using a simultaneous multi-path search method. In contrast with Dijkstra's algorithm, several nodes can be determined at one time. Moreover, we partition the network into different groups (network groups) and find the all-node pair's shortest path in each group using a pipeline operation. Networks can be abstracted, and the shortest paths in very large networks can be found easily. The proposed scheme can decrease calculation time from $O(N2)$ to $O(N)$ using a pipeline operation on DAPDNA-2. Our simulations show that the proposed algorithm uses 99.6% less calculation time than Dijkstra's algorithm. The proposed algorithm can be applied to the very large Internet network designs of the future [1].

2.3.2 Decision Making Strategies for Intelligent Control system of Train Speed & Train Dispatch in Iran Railway

As railway transportation is a monoblock system, smallest changes in a train movement cause many changes at timing program. Compensation of deviation from scheduling program in earliest time will cause optimal utilization from locomotive, wagon and line.

Scheduling table contains information about arrival and dispatching and duration of stop time of each train in every station. It is assumed that scheduling table is accessible and goal is to propose program that has more adaptation with scheduling table of train movement at any moment. Laws like maximum permissible speed of line or maximum permissible speed of train and amount of existence noise, produce limitation in proposed control strategy [2].

Two fuzzy systems are proposed for designing this system.

1) Fuzzy controller about speed of train that proposes specific speed at any moment. This system causes uniformity control on train movement and efforts for compensating changes from scheduling table as soon as it possible. This controller can act as an automatic train driver for conducting transporter.

2) Fuzzy controller about controlling of dispatching trains that if fuzzy controller about speed of train could not compensate delay of train until arrive to next station, centralize fuzzy controller in station decides for dispatching. This system proposes program has more adaptability with scheduling table of train movement. It must decide which train will have the preference to occupy the distance between stations and which must stop at a siding. This centralize fuzzy controller could be replaced instead of manpower.

Trains movement is according to scheduling table that is called master graph and will take place every season constantly deliver of staffed station. Scheduling table contains information about arrival and dispatching and duration of stop time of each train in every station. Beside of this problem, different causes such as delay and priority of trains or special exploitation goals, such as added train to network or interim destruction of line will cause many changes at timing program at vast aria of network. Without a useful controller because of accumulating deviation from scheduling table, coordination of trains movement is wear off and disorderliness produces in trains movement .In this time at a piece of route trains have long distance together and in other piece aggregate trains and finally system will afoul noise and loss of efficiency. Finally this noise is cause of breaking movement rules and bane or fiscal dangers. Therefore, two operations are effective in control. Train driver and train dispatcher.

2.3.3 Least-Cost Path in Public Transportation Systems with Fare Rebates that are Path-and Time-Dependent

This system consider a new class of shortest path problems: path-dependent shortest path, in which the cost of an arc *(i,j)* in a path *Pd,* from some nodes to j, is dependent on the arc *(i, j)* as well as the preceding path *P,* This class of problems arises when this system consider fare rebates in many integrated public transportation systems (buses and subways) where rebates are given to a commuter when he switches service lines.

In this project show that the path-dependent shortest path, in general, is NP-complete whereas its special case, the suffix-k path-dependent shortest path, can be solved by any standard shortest path procedure in polynomial time with a technique called dual path graph transformation. This project also discuss a realistic application of path-dependent shortest path in finding least cost path in the context of public transportation system in Singapore where fare rebates are given to commuters when they switch service lines. The fare rebates are path-dependent and time-dependent. We give a fast polynomial time algorithm for this problem that combines past techniques for handling simpler versions of least cost paths problems. This system also proves key properties of our model in order to gain computational efficiency [3].

In some multi-modal public transportation (buses and subways) systems, rebates are often given to commuters when he switches service lines during the same trip. For example, when a commuter transfers from one service line (say *I1*) to another (say *I2*) in some limited time, be enjoys some fare rebate on *I2*. In general, the amount of rebate can vary depending on many factors such as whether the two service lines belong to the same company, the fares for the previous trip segments, and so on.

Take the case of public transportation in Singapore as an example and model the underlying graph in a natural way as follows: each stop station is modeled as a node and each pair of adjacent stops in a service line is connected to form an arc (note that the graph thus resulted is a multi-graph since there could be multiple service lines, and thus arcs, between two nodes). Let *Tex* be the rebate expiry duration. Suppose there are three service lines *L1,L2* and *L3,* and the next departure time for lines *L1* and *L2* at stop *S1* are *T1* and *T2,* respectively, and the next departure time for line *L3* at stop *S3* is *T3* (where T1< *T2* < T3) **Figure 2.1** . If a commuter wants to travel from *S1* to *S4,* he has two choices:

R1: *S1+S3+S4* (At *S1,* take line *l1* at time *T1* to travel to *S3,* then transfer to line *L3* at time *T3);*

R2: *S1+S2+S3+S4* (At *S1,* take *L2* at time *T2* to travel to *S3,* then transfer to line *L3* at time *T3);*

Without fare rebates, the least cost path from *S1* to *S4* will be R1 with a total cost of 120 (cost of R2 is 130). In a system with fare rebates, however, this may not be true. Suppose fare rebate is of 15 units, when the commuter takes *L1* be will enjoy this rebate only if he makes a transfer before time *T1+Tex* similarly, if he takes *L2,* rebate will be given only if he makes a transfer before time *T2+Tex* . Therefore, it might be the case that *T1+Tex* < *t3* < *T2+Tex,* such that the least cost path from *S1* to *S4* is R2 with a total cost of 115 (with the rebate of 15). In this case, we note that rebate violates the well-know optimality principal used as the basis for many shortest path algorithms (Figure.2.1). Specifically, in R2 (the optimal path with rebate), the sub path SI to S3 (via *S2)* is sub-optimal.