Mala[illegible]ute Adviser: Hybrid Dijistra's Algorithm.

By

MOHD SYAFIQ BACHOK

PROJECT SUBMITTED IN FULFILMENT OF

THE REQUIREMENT FOR THE DEGREE OF

MASTER OF COMPUTER SCIENCE IN SOFTWARE ENGINEERING AND SOFTWARE ARCHITECTURE

IN THE

FACULTY COMPUTING AND INFORMATICS

MULTIMEDIA UNIVERSITY

MALAYSIA

JANUARY 2014

ABSTRACT

Time past by time, 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. 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. According to this problem MANTRA provide the solution to resolve the problem and help the tourist to plan their journey using Hybrid Dijkstra algorithm in the Mantra System.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

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 report.

1.1 Introduction

Malaysia Network Transit Route Adviser (MANTRA) is android application that develops 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' provides 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. To find the best result, this application using the Hybrid Dijkstra algorithm to find the result and give the advice to users base on the users destination choose.

This system is a mobile application using web service architecture, java language and Netbeans 7.1 to develop the system. The system will interact with a single enterprise database thought My SQL.

1.2 Problem Statement

At this time, for tourist want to go traveling using Malaysia Transit, through the manual system, firstly tourist must find the Malaysia transit network map. After that tourist must do some research to find the best way for traveling using Malaysia Transit. Tourist must estimate and calculate the cost traveling manually. Lastly from the information tourist must write the planning to go traveling using Malaysia Transit.

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 [1] and from KL Sentral to Masjid Jamek is RM 1.30 [2]. 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 [1] and from Bandar Tasik Selatan to Masjid Jamek is RM1.70 [2]. The total amount of this journey is RM2.70. Base on comparison above, we realized that because of each travelling for everyone 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 travelling 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 which is not accurate also being a sector that contribute in the train problems. Sometime, the trains always delay it time and this will disturb everyone's 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 felling at all. 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. Not only that, for many times the train also will stop moving in between stations that is on the rail and everyone has to wait at the train station until the problem has been settled.

1.3 Objective

i. To investigate the current method used inMalaysia Transit Network Route Adviser based on Dijkstra algorithm that estimate shortest route path and traveling cost.

ii. To develop and test the proposed method in terms of functional and non-functional testing.

1.4 Scope

The propose Malaysia Transit Network Route Adviser system will focus in the following scope:

i. The propose Malaysia Network Transit Route Adviser System is an application, which is developed for user to find the shortest path and/or the cheapest cost to travel using Malaysia Transit Network.

ii. The propose system consists of 5 types of train services comprising of 112 stations. The data is currently being stored in a database and the data can be modified, deleted and inserted by the admin through direct access to the database.

iii. The propose applications is built for Android Operating System environment version 4.1.2 for development and testing purposes. However the propose Malaysia Network Transit Route Adviser Services are expected to work on other platforms since they were program as a web service in which web service supports multi-cross platform integration.

1.5 Organization of the report

This report 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 Studies of Existing Systems

2.1.1 Malaysia Transit

Kuala Lumpur's rail-based transit system consists of two Light Rail Transit lines (rapid transit), one commuter rail lines, one monorail line and an airport rail link to Kuala Lumpur International Airport, which consists of an express and a transit service.Initially, different companies operated the various systems and having developed them separately at different times. As a result, many of the lines do not integrate well, making transferring from system to system inconvenient for passengers. Moving from one system to another often require a lot of walking, stair-climbing, escalator-use and even crossing busy roads. For example, the KL Monorail's "KL Sentral" station is a 140-metre walk away through a busy bazaar and a busy road. There is also

no common ticket for all systems, forcing commuters on continuing journeys to buy new tickets when transferring [3].

2.1.2 Android Application (Malaysia Kuala Lumpur Transit)

Malaysia Kuala Lumpur Transit one of the android applications has in the market (Figure 2.1) [4]. Base on my review on this application I found several problem and weakness in this application such as:

i) This application actually not includes all transit station at Kuala Lumpur. That application only support for Putra LRT and KL Monorail station.

ii) The information about the transit is already hardcoded and no algorithm implement in this application. That means all information about the fares includes in this application and not updated.

iii) This application does not support the travelling time between stations.

Figure 2.1 : Malaysia Kuala Lumpur Transit Application.

2.2 Studies on Existing Method / Technique / Approach

Route calculation is the most important part of Malaysia Network Transit Route Adviser (MANTRA) and MANTRA routers typically use Dijkstra's algorithm. This is a simple algorithm that efficiently calculates the shortest paths to all destinations. The single-source shortest path (SSSP) problem is the problem of finding a path between two nodes that minimizes the sum of the weights of its constituent links. The algorithm incrementally organizes a tree structure rooted at the source. All of the router's neighbors are added to a candidate list, with costs equal to the cost of the links from the router to the neighbors. The router on the candidate list with the smallest cost is then added to the shortest path tree, and that router's neighbors are then examined to determine whether they can be included in the candidate list. The algorithm then iterates until the candidate list is empty.

2.2.1 Shortest Path Algorithm (Dijkstra's algorithm)

Dijkstra's algorithm is called the single-source shortest path. It is also known as the single source shortest path problem. It computes length of the shortest path from the source to each of the remaining vertices in the graph.Dijkstra's algorithm works by solving the subproblem k, which computes the shortest path from the source to vertices among the k closest vertices to the source [5]. For the dijkstra's algorithm to workit should be directed- weighted graph and the edges should be non-negative. If the edges are negative then the actual shortest path cannot be obtained.

2.2.1.1 Advantage Dijkstra's algorithm

- Once it has been carried out you can find the least weight path to all permanently labeled nodes [6].
- Dijkstra's algorithm has an order of node so it is efficient enough to use for relatively large problems [6].

- Once it has been carried out you can find the least weight path to all permanently labeled nodes [6].

2.2.1.2 Disadvantage Dijkstra's algorithm

The major disadvantage of the algorithm is the fact that it does a blind search there by consuming a lot of time waste of necessary resources. Another disadvantage is that it cannot handle negative edges. This leads to acyclic graphs and most often cannot obtain the right shortest path [6].

2.2.1.3 Application using Dijkstra's algorithm

- Traffic information systems use Dijkstra's algorithm in order to track the source and destinations from a given particular source and destination [7].

- OSPF- Open Shortest Path First, used in Internet routing. It uses a link-state in the individual areas that make up the hierarchy. The computation is based on Dijkstra's algorithm which is used to calculate the shortest path tree inside each area of the network [7].

2.2.1.4 Design and Implementation of Multi-Parameter Dijkstra's (MPD) Algorithm: A Shortest Path Algorithm For Real-Road Networks.

i) **Problem Statement**

A key problem in network and transportation analysis is the computation of shortest paths between different locations on a network. Sometimes this computation has to be done in real time. For the sake of illustration, let us have a look at the case of a 108 call requesting an ambulance to rush a patient to a hospital [8].

ii) Implementation of MPD in Jaipur City

MultiparameterDijkstra's algorithm (MPD) uses multiple parameters such as distance, cost and congestion across the routes. Using the proposed algorithm, a navigation system for Jaipur city has been suggested by us. The database for Jaipur city was created and graph has been generated from the database. From the graph, the shortest path was calculated and the results were displayed. In the navigation system that has been designed by us, the user can view the shortest path, the bus routes that are available for Jaipur Bus and the congestion across the routes. The congestion factor varies on a scale of 1 to 10. Higher the value of congestion factor, higher is the traffic congestion across the specified route [8].

The Multi-parameter Dijkstra's algorithm has been tested on Jaipur city database and it has been found that it is capable of displaying not only multiple routes but the optimal path between any source-destination pair. Also, the incorporation of congestion factor provides greater flexibility to the user so that he/ she can choose a route that is less congested [8].

iii) Comparison of MPD with other modifications of Dijkstra's algorithm.

No	Criteria	Algorithm	Comparison with MPD
1	Number of parameters	Dijkstra's Algorithm [8]	Considers only one parameter as compared to MPD that uses multiple parameters
2	Space and time	Dijkstra's Algorithm with Buckets (DKB) [8]	1. More space required for nC+1 buckets 2.Extra time required for sorting buckets MPD does not have any such overhead
3	Space	Dijkstra's	Requires extra space for two levels

		Algorithm with Double Buckets(DKD) [8]	of buckets. No such requirement in MPD
4	Accuracy	Dijkstra's algorithm with Approximate Buckets (DKA) [8]	Makes approximation about the distance labels stored in a bucket that are within a certain range and this can lead to approximate results about the shortest path.
5	Space	Dijkstra's Algorithm with Overflow bag (DKM) [8]	Requires maintenance of the overflow bag. No such overhead is there in the proposed algorithm.

2.2.2 Travelling Salesman Algorithm (TSA)

Travelling Salesman algorithm is given a set of cities and the cost of travel (or distance)between each possible pairs, the TSP, is to find the best possible way of visiting all the cities and returning to the starting point that minimize the travel cost (or travel distance). Given n is the number of cities to be visited, the total number of possible routes covering all cities can be given as a set of feasible solutions of the TSP and is given as (n-1)!/2 [9].

2.2.2.1 Advantage Travelling Salesman Algorithm

- This is very useful for complex or loosely defined problems[9]

2.2.2.2 Disadvantage Travelling Salesman Algorithm

- A practical disadvantage of the Travelling Salesman algorithm involves longer running times on the computer. Fortunately, this disadvantage continues to be minimized by the ever-increasing processing speeds of today's computers [9].

2.2.2.3 Application using Travelling Salesman Algorithm

- Slightly modified, it appears as a sub-problem in many areas, such as DNA sequencing [9].
- In these applications, the concept city represents, for example, customers, soldering points, or DNA fragments [9]
- The concept distance represents travelling times or cost, or a similarity measure between DNA fragments [9].
- As TSP is a NP hard problem it is often used as a benchmark for optimization techniques [9].

2.2.3 Hypertext Markup Language 5 (HTML 5)

HTML5 will be the new standard for HTML.The previous version of HTML, HTML 4.01, came in 1999. The web has changed a lot since then. HTML5 is still a work in progress. However, the major browsers support many of the new HTML5 elements and APIs [10].

HTML5 is cooperation between the World Wide Web Consortium (W3C) and the Web Hypertext Application Technology Working Group (WHATWG). WHATWG was working with web forms and applications, and W3C was working with XHTML 2.0. In 2006, they decided to cooperate and create a new version of HTML. Some rules for HTML5 were established [10]:

- New features should be based on HTML, CSS, DOM, and JavaScript
- Reduce the need for external plugins (like Flash)
- Better error handling
- More markups to replace scripting
- HTML5 should be device independent
- The development process should be visible to the public.

CHAPTER 3

METHODOLOGY

In this chapter, a brief explanation about the methodology used for developing the application will be provided. This chapter also details out the system development life cycle besides software and hardware specification that are needed for this project development.

3.1 Introduction

Methodology is a codified set of recommended practices, sometimes accompanied by training, formal education programs, worksheets, and diagramming tools. It documented a set of procedures and guidelines for one or more phases of the software life cycle, such as analysis and design. Many methodologies include a diagramming notation for documenting the result of the procedure and an objective (ideally quantified) set of criteria for determining whether the results of the procedures are acceptable quality.

3.2 Software Development Life Cycle (SDLC)

There are many methods that can be used in software development. Software Development Life Cycle (SDLC) model is a classis approach to the systems development life cycle. The SDLC methodology tracks the project from the starting of the idea of development, thought a possibility study, system analysis and design, programming, testing, implementation and pre-implementation analysis. This methodology is the best practice for most of the system development. It provides a consistent framework of tasks and deliverables needed to develop systems [11].

The systems development life cycle (SDLC) can return to earlier phase if necessary beside this method provides consistent framework of task and deliverables needed to develop system [11]. In addition, it is possible to complete some activities in one phase in parallel with some activities of another phase. Sometimes, the life cycle can be iterative because the phase is repeated as required until acceptable state is found. The figure below showed the flow of the Software Development Life Cycle (SDLC) methodology.

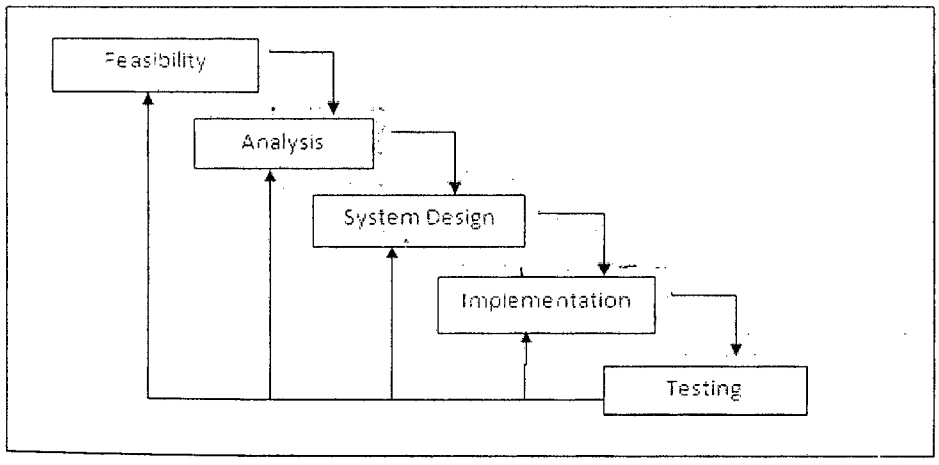

Figure 3.1 System Development Life Cycles (SDLC)

To compare with this project development, all the phases will be applied. The model for this research is implementing the phase of feasibility, analysis, design, and development and testing.

3.3 Feasibility

This phase is to establish a high-level view of the planned project and determines its goals. The scope of the project is identifying to give specific range that will cover up in the project.

The planning began when the proposal of this system approved by the Final Year Project Coordinator. After that, a schedule has been made a guide along the system development to make sure it can be finished at the given time. The schedule starts from defining the scope, searching data until the end of development and testing. All the system planning is being done in Gant chart using Microsoft Project.

3.4 Analysis

Analysis is the phase where all aspect being analyzed. It is analyzed the function of goal that apply in the system and suitable technique that use in the system. System requirement is the basic if developing this application. In developing new system, it is compulsory to identify the software, hardware or many other resources that will be used. In this phase, it is more on research about the system and classifies the user's needs from the system. The activity will engage the study about the structure of the system. It also determines the software and hardware requirement used to develop the system. This phase is an important phase effect the application development.

There three (3) part of analysis that use for the purpose of the system which is can improve the result of project development. There are:

i. Requirements and previous system information

Requirements and previous system information analysis can be defined in the literature review chapter that include in chapter 2 of the report.

ii. Data that use for the system

Data of the system is node and cost from one node to others nodes. However, the analysis of the suitable data that use for the system are choose based on the suitable technique that use for the system.

iii. Technique that use for the system

Define the Algorithm to uses for resolve the problem in this application (Hybrid Djikstra's Algorithm).

3.5 System Design

System design is to describe desired features and operations in detail. After analyzing of the problem statement that occurs, disadvantages of the previous system, this phase manage to come out it a solution to overcome the problem.

This chapter will describe about the phase involved in developing the Malaysia Network Transit Route Adviser. There are four phase in MANTRA, i.e. data collection, system design, system implementation and system functionality testing. Every phase has its own module.