Multi Bus Ride Guide System

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Abstract

In this paper, I will make a bus ride route system for those who might like to use. The system was developed by using statistics and computer algorithms. The system is based on those complicated bus route data model. This paper will completely explain how the algorithms use in finding several route sets from one bus station to another.

There are many bus station information site have applications that can offer the bus stops’ information. But those applications can not tell you “how to take” from one site to another, but different route of the bus. For instance, I need to know how to arrive place B by taking bus in place A, and what stop I should get off the bus, what bus I should take to another stop. This Paper will describe how this application build and work.

Introduction

The use of database is not only extensive but also complicated. Generally speaking, it is mostly used in business to tackle problems in personnel, commodity, monetary and systematic management.

And those basic functions in database, such as search, filtering, and integrate and so on and also contribute to my making this plain with database. Besides, I also like to make
use of this chance to improve my skill in design and implement database projects.

I thus ask for the chance of the local science exhibition to search and collect information for database and its programming language. In this paper we not only introduce you how the system work, but we also discuss the bottleneck brought about calculating among the database. Besides, we will talk about how problems arise and how they will be worked out; I offer some improving measures for that highly difficult technology.

**Method of Research**

(A) Forward

It is of course impossible to make use of this application without a database; therefore, I would like to introduce first of all the idea of database table structure, it’s ideal of design, and corrections made up revising database. Following is part of the system to explain mainly the process, improvement of device and some of my opinions.

(B) Database Structure Design

1. Table to be used included:

   (1). Map

   (2). Data about buses and bus stations.

   (3). Data about roads and traffics condition records.

   (4). Data about the riding habits of average passengers.

   (5). Data about the distribution of buses by bus companies in different roads
and the service manners of the bus drivers.

2. Other database will be used to store away user’s personal information, and to keep temporary database table during the programming.

3. Name of database tables and table structures.

**File name: MAP.DBF**

Function: To store MAP information, and mathematics coordinates, and other related data.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapname</td>
<td>Name of Map files</td>
<td>Character</td>
<td>20</td>
</tr>
<tr>
<td>Block_x</td>
<td>X coordinates on the Map</td>
<td>Integer</td>
<td>4</td>
</tr>
<tr>
<td>Block_y</td>
<td>Y coordinates on the Map</td>
<td>Integer</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 1. MAP.DBF table structure.

**File name: BUS.DBF**

Function: Store information of buses, its routes, and stops.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Bus number</td>
<td>Character</td>
<td>9</td>
</tr>
<tr>
<td>Com</td>
<td>The company of the buses.</td>
<td>Character</td>
<td>8</td>
</tr>
</tbody>
</table>
**Beg**
Dispatching bus stop.
Character 12

**End**
Returning bus stop.
Character 12

**Bt**
Dispatching time of the first run.
Character 5

**Lt**
Dispatching time of the last run.
Character 5

**Se**
Bus dispatching intervals.
Character 5

Figure 2. BUS.DBF table structure.

**File name: STATION.DBF**

Function: Store information of each bus stop and other related information.

<table>
<thead>
<tr>
<th>Field Name</th>
<th>Description</th>
<th>Type</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Bus number</td>
<td>Character</td>
<td>9</td>
</tr>
<tr>
<td>Station</td>
<td>Bus stop name</td>
<td>Character</td>
<td>12</td>
</tr>
<tr>
<td>Serial</td>
<td>Serial number count from the first stop.</td>
<td>Integer</td>
<td>4</td>
</tr>
<tr>
<td>Heavy</td>
<td>Rush hour traffic condition value.</td>
<td>Integer</td>
<td>4</td>
</tr>
<tr>
<td>Normal</td>
<td>Normal traffic condition value.</td>
<td>Integer</td>
<td>4</td>
</tr>
</tbody>
</table>
There are other database tables, such as Tmpstation.dbf is to be used to store away data user input in advance, data structure is like station.dbf, Userrecord.dbf are used to keep record of the process.

4. Idea of designing:

I gather the information from the map. While I was doing this, I ask myself how to call the map. Should I put the filename into the procedure? It would cause inconvenience to keep it intact. So I suddenly have the idea of using database to store away the filename so that the computer can find it itself.

When I opened the bus guide page by page, I began to think whether I should use one single data table or several divided data tables to store away information. Both have their advantages and disadvantages. Based on my experience and my teachers, I have the following results:

<table>
<thead>
<tr>
<th>Easy</th>
<th>Off-peak traffic condition value.</th>
<th>Integer</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Level of the stops (i.e., big stops or small stops)</td>
<td>Integer</td>
<td>4</td>
</tr>
<tr>
<td>Block_x</td>
<td>X coordinates on the map.</td>
<td>Integer</td>
<td>4</td>
</tr>
<tr>
<td>Block_y</td>
<td>Y coordinates on the map.</td>
<td>Integer</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 3. STATION.DBF table structure.
<table>
<thead>
<tr>
<th></th>
<th>Single database table</th>
<th>Multi-database table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Programming</td>
<td>Easy</td>
<td>Little Difficult</td>
</tr>
<tr>
<td>Search Speed</td>
<td>Slow</td>
<td>Fast</td>
</tr>
<tr>
<td>Program Maintenance</td>
<td>Easy</td>
<td>Difficult</td>
</tr>
<tr>
<td>Data Maintenance</td>
<td>Very Difficult</td>
<td>Easy</td>
</tr>
</tbody>
</table>

Figure 4. Advantages and disadvantages between single table and multi-table database condition.

Because of the sizable data of bus and bus stops, I finally decide to use several divided tables instead of on single table. I make my decision after careful consideration and analysis. Thus, bus data and bus stop information are separated.

Following is one of those interesting things happening when I am changing data. Serial in the Station column is originally designed to store away data according to bus stop number and the total number of bus stops. However, whenever I try to make use of the data, I found I have to change Character to Integer. This is troublesome. Therefore, the present style is the bus stop number only. As to the total number of bus stops, I leave it to the computer program.

3 users’ records and system temporary records. The main purpose of this data table is to record related data which users’ store away before. It provides smarter way of operation and makes it easier to search and inquire information.

System temporary data is to make computer more humanized to reduce the
frequency of conversation between the computer and the users.

In this way, the computer becomes smarter and smarter and is more intuitive and friendly.

(C) Programming Design

1) **Foreword:** Program designing is divided mainly into two parts: Data Processing and Search Algorithm. Data Processing is the procedure which MIS must have. However, so far as my play is concerned, Search Algorithm is what it counts.

2) **Data Processing:** I will introduce respectively the following functions, APPEND, MODIFY, DELETE, and SEARCH

a) **APPEND**

i) **Worth mentioning:**

When I input bus stop for test and run, I make use of temporary file and put the users’ names in. This change is to reduce the number of database recording so that it is easy to keep the data intact.

When I input the bus stop name, the computer will check the main database to see if there is the same bus stop name input before. If there is, the computer can call out the record so that the users can input data into it.

ii) **Problem arises:**

The computer can check to see if there is repeated input before the user finish input. If there is, the computer will tell users to
modify those repeated data.

b) Modify

   i.) Why three ways of modification

   If bus data is alone to be modified, like dispatch interval, then it is unnecessary to change the main database. For example, if bus stop data like the stop name is to modified, it will be necessary to check the unique of the data. And to further change all the related data in the database. More complicated check procedure must be taken before the changes of main database if the whole route should be changed or if a new route is added.

   The way delete and check are made mostly originates from two major subject designing basis. Their difference lies mainly in procedure call and events caused by Click Event.

3) Search strategy:

   I will explain data origin and procedure design.

Procedure design

   Idea: Suppose I input from Taipei Railway station to Chinese Cultural University, the computer will show from database the way to take a bus.

Problems that we need to overcome

   a. How to sum up traffic condition?

   b. How to know bus schedule?
c. How to make sure the bus route from stop A to stop B?
d. If a bus transfer is to be taken, what should we do?
e. If more bus route is available, what should we do?
f. How to arrange data of more than one bus?
g. How to get the relative location between A and B?
h. What search algorithm is supposed to be used?

Solutions for the problems:

The route the bys takes:

People who live in the North and in the South of Taiwan will leave different opinions about which route is better or worse, but computer treat all routes the same way.

Therefore, I set the Taipei Railway Station bus stop as longitude zero degree and latitude zero degree (0, 0). The bus stop to the left will be longitude minus one degree (-1, 0) and the bus stop to the left and down will be longitude minus one degree and latitude minus one degree (-1, -1).

Thus each bus stop has it exact location in coordinates. If more than on bus is to be taken in a single route (or transfer), what should we do to inform the computer of the bys stop where we take the transfer and the route arrangement?

The following figure will show you the way:

<table>
<thead>
<tr>
<th>(-3, 2)</th>
<th>(-2,2)</th>
<th>(-1,2)</th>
<th>(0,2)</th>
<th>(1,2)</th>
<th>(2,2)</th>
<th>(3,2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-3, 1)</td>
<td>(-2,1)</td>
<td>(-1,1)</td>
<td>(0,1)</td>
<td>(1,1)</td>
<td>(2,1)</td>
<td>(3,1)</td>
</tr>
<tr>
<td>(-3, 0)</td>
<td>(-2,0)</td>
<td>(-1,0)</td>
<td>(0,0)</td>
<td>(1,0)</td>
<td>(2,0)</td>
<td>(3,0)</td>
</tr>
</tbody>
</table>
Suppose you take a bus from stop A to stop B and the coordinate of stop A and stop B are (-1,-1) and (2, 1) respectively, the formula \((X_b-X_a)>0\) can shows that the bus is eastward. Whether the bus is northward or southward can also be shown in the Y coordinates. In this way, we know the bus direction. Following is the way to figure out the route the bus takes.

Figure 5. Bus stops coordinates.

![Table of Bus Stops Coordinates](image)

<table>
<thead>
<tr>
<th>(-3,-1)</th>
<th>(-2,-1)</th>
<th>(-1,-1)</th>
<th>(0,-1)</th>
<th>(1,-1)</th>
<th>(2,-1)</th>
<th>(3,-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-3,-2)</td>
<td>(-2,-2)</td>
<td>(-1,-2)</td>
<td>(0,-2)</td>
<td>(1,-2)</td>
<td>(2,-2)</td>
<td>(3,-2)</td>
</tr>
<tr>
<td>(-3,-3)</td>
<td>(-2,-3)</td>
<td>(-1,-3)</td>
<td>(0,-3)</td>
<td>(1,-3)</td>
<td>(2,-3)</td>
<td>(3,-3)</td>
</tr>
</tbody>
</table>

Figure 6. The algorithm for making route from A to M.

![Diagram of Route Algorithm](image)

If the user input bus stops from A to M, the computer takes three blocks from A to M. They are B, B2 and B3 (All are big stops, level 5). Through mathematics formula, we can tell which stop is the nearest to the stop M. The nearest is B1. We do the same thing from Stop B1 To stop M and take three blocks, C1, C2 and C3.

According to this way, we can have D1 and E1. The computer will figure out the route A->B->C1->D1->E2->M.
(The importance of the bus stop I defined as “Level” is to classify small traffic condition bus stop and heavy traffic condition bus stop. The level I gave is from small 1 to 5.)

Then the bus stops where passengers take transfer are level 5 big stop because they have most buses pass by.

**Arranging data**

Suppose we have a route A->B->D->E, the computer will search from stop A to stop B and find out all the buses with the same number. (i.e., the buses that pass by stop A will also pass stop B)

It will put all these numbers in Data1. From bus stop B to stop D, the numbers will be put in Data 2. The same can be done to stop D to stop E and so and so forth.

Suppose from stop A to stop B, we find bus number 232, 39, and 211, from B to D we find 39, 211, from D to E we find 11,306,508, we can do as the following: Pick out 232 in Data1 and then look for 232 in other data. If there is no 232 in other data, then we can shift to bus 110, 39. If we find 39 in other data, then we find out the bus stop that is nearest to the terminal and keep record. And compare to result with the result we have before. We hope that passenger can reach their destination in the fewest number of bus stops.

Finally we find the information we need from temporary database in order to know which stop to take and which bus to
take.

**Analysis of various bus dispatch situation.**

Put all the values of bus traffic situation together, and we have the traffic situation. We can also work out the time a bus ride takes if we know the bus schedule.

**Worth mentioning.**

When you find a bus route, you can also take a look at the map for bus transfer stops. File this records are not easy. Or you can print the result of checking or those information related to bus stops.

4) **Study procedure and method.**

I have trued to introduce my study procedure in the most clear way, but because there are too many programs, I cannot finish my introduction if I introduce in great details. Therefore, I introduce my most troubled search algorithm. How I wish to finish my introduction! How I want to share my design idea and experience with others! How enthusiastically I want to do it.
Research result and discussion

Data disposition

While I am inputting bus stop information, I find that some buses run different routes in their going and returning. Take bus no.232 as an example, I passed by stop A, B, C and D, but in its return route is D, X, Y, C, W, B, A. Thus irregular routes will do nothing to the search algorithm. However, it affects greatly the stop by stop search strategy, it will lead to a dead alley.

Being afraid that there is fewer information

Owing to the limit of my energy, I can only use my plan in the Taipei city area so that I have enough data models to make experiment and test.

So in the period of study and development, I am really afraid that my data model is been limited. I am afraid I can not finish my search smoothly. Every bus route in Taipei has an average of 23 stops. 80 routes will have 2000 bus stops.

The making of map data

I really want to give every bus stop a stop name and its location. However, this will be more energy-consuming. Before you set exact location of a bus stop on the map, you have to arrange all data first.

Although there are problems of data style in my data design in my plan, I think this plan is the most efficient among other plans that I have made. You cannot have your cake and eat it, too. So far as my concerned, the plan is the best.
Program design

This time I use Object Oriented Programming for my project. I have never done this in this way before. However, I always have the idea that you must force yourself to learn as if you have to do something because of the situation.

With my persistence, I spend several weeks to figure out the concept of Object Orientation and establish the concept more firmly.

Data processing

The programs for this data processing centers on the uniqueness and completeness of the data. The special procedure I work out myself makes it possible for the change of data not to affect the completeness of the main database.

In other words, I transfer the data from the main database to the individual database. I do my best to deal with the data in such individual database. After I finish this, I will change the main database. The advantage of such design consists in the fact that I can control the main database and write the program easier. I will not be finished if I choose the wrong data.

The design of the procedure

Under the OOP circumstances, every window belongs to a kind of object. So the interaction among each the procedure is great challenge to me. Under the Clipper circumstance, all programs from zero to on are written by myself. Therefore, there will be no problems with the communication among every sub-procedure. Yet, in this advanced Database Manage Environment, most of the
procedures are included in the FORM object. Since I have just touched this language, this new circumstance is a new challenge to me.

**Search Strategy**

At this point, I came to realize the pleasure Dr. Sun Yat-sen experienced when he succeeded in his revolution after 12 times of failure. I succeed in my search strategy revolution after 37 times of failure.

In fact, I became a little too critical in the last ten times. Any way, I hope that my programs are perfect, although every program has both its advantages and disadvantages among so many ways.

Because the origin of data is not as definite as I have designed before, I give up, in my last correction, part of the design idea I have before. I use other idea and method to replace my previous design idea. It is painful not to change and stay the same way.

**User Interface**

I always try my best not to make people reject using computer. Once when I was watching a program on Discovery Channel, I feel that off-edge technology intimidates people. As for my plan, I hope everyone can use it and I also hope it has powerful function.

The programs appear if everyone knows how to use them. And when they appear too powerful, they cause difficulty for people to learn with them. It takes great window technology to strike a balance between them.
**Conclusion**

Good study must go on and my plan is no exception. Whenever I sit before computer and look at the program on the screen, I have the repeated urge to pursue perfection and improvement. Many times, I correct a form over a hundred times. It seems that my correction is endless.

The good point of my plan are:

1. Superior ways to search for bus route.
2. Intimate process of conversation.
3. Sharp and contrast window colors.
5. Control of database.
6. Proper and timely use of certain logic to analysis database.

The above features help a lot to upgrade the efficiency of using computer and to apply computer data to achieve the purpose of our lives. The fault lives in the deficiency of data on an average.

Besides, the routes that computer shows is sometimes a little difficult from those real bus routes. As to those procedures, I present some of their designs really provide good for thought although they are not very big and evident.
Reference


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