AN EFFICIENT AND COST EFFECTIVE PUBLIC BUS TRANSPORTATION TIMETABLING ROUTING AND DRIVER DUTY SCHEDULING USING MATLAB

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Abstract
This paper will provide guidelines for bus planning operators to develop an efficient and cost-effective Public bus Transportation route and schedule in MATLAB software. The main objective of public transport planning is to optimize the operational cost on the entire network. Then, its profit, level of service and competitiveness can be improved. Bus service scheduling and driver duty scheduling have done in Matlab where scheduling of up to 5000 drivers can be done. This Project will provide guidelines to find the Bus Network Flow Graph for hundreds of Buses. It also provides the shortest path (Based on Distance, Cost) several through the Entire Network of flow Graph.

Keywords: Bus Network Flow Graph, Shortest Path Problem, Network-Model, Vehicle Routing problem (VRP),

I. INTRODUCTION
The buses and trains play a very important role in public road transportation system. There is a great need of having user & transit friendly transportation system. In public transportation system there is one depot node and others are sub depot nodes (where pickup & drop up of passengers has been take place). So in order to become Public bus transportation more economical and environment friendly, it is required to have the most optimal planning in bus transportation.

In transportation problems, if the size of transportation route has been reduced then it leads to considerable reduction in relative cost. So it is budget saving for transportation company. Since it is directly related with fuel consumption

The aims of this scheduling method are: (i) to make best use of the drivers, assets and financial resources; (ii) to improve the on road vehicle efficiency; (iii) to optimize route, operational cost.

Thus there is need of Research & Development in timetabling, routing and scheduling of vehicles in public transportation. So that it will meet to the Passenger’s trip demands. This problem has been remarked by many public transportation experts all around the world. For the any Bus Depot, the main objective of public transport planning is to optimize the operational cost on the entire network. Then, its profit, level of service and competitiveness can be improved Planning of public transport is one of the issues which use the bus routing method Stations having hundred, and upto thousand, Buses on each day are common throughout Maharashtra. So these Bus station have more number of intermediate Routes, which are connected to the sequential stopping points (stations), The Buses differ in their categories, running speed, departure time and arrival time, starting point and destinations.

The advantage of having transportation system with an automation is that such transportation system gives an efficient schedules, it will reduce the driver duty time for duty scheduling, it gives optimum solution for transportation problem.

Therefore there is need of research in the timetabling, planning and scheduling of buses. The planning and scheduling is highly complex problem

II. LITERATURE ON RELATED WORKS
Various methods are proposed for the vehicle routing problem. Jing-Quan Li[4] introduces many methods for solving the vehicle routing problem. The Bus Depot Platform allocation and routing can be done using different schemes.

Park and Kim (2010) [7] presents proper schedule for a allocation of buses where every bus picks up student from various bus stops and then drop them to the school.

III. PROPOSED WORK
Through analysing different methodologies, this project will provide guidelines for bus planning operators to develop an efficient and cost-effective Public bus Transportation route and schedule. Since finding the optimization for this
problem manually is very tedious task also it requires large computation time. It is possible to solve shortest path problem in Matlab.

A. Reading Xls Sheet into Matlab Software.

Implementation for accessing the database from excel to matlab can be performed by using two different approaches

- Excel sheet data can be used as an intermediate data
- Using Matlab and Computer languages like C,c++ it is possible to access the given database

**Fig.1 Case Study Data Files Into Xls Format.**

![Database](image1.png)

**MATLAB**

**Fig.2 Implementation For Accessing The Database From Excel To Matlab [10]**
Output Command Window in the Matlab:

B. Bus Network Flow Graph:

It should include all the services available from Source Node to Destination nodes. It can be Draw By Inspecting the available time table, it contains the all available services. Rectangular box indicates the Nodes and Directed line indicates the distance from Source to Destination. We have taken the example of Islampur bus depot in which there are total 812 number of services available. It should be required to implement the time table with using minimum number of bus count.

Here Matlab based Bus Network Flow Graph shown in fig.3 contains all the services from depot node to the various destination nodes.

C. Matlab GUI Window:

The figure 4 below shows the snapshot for a bus network consisting of several nodes in MATLAB. The Matlab GUI should contain the following Field:

- Input Bus Data
- Transportation Profit
- Optimum Travel Time
- Bus Network Flow Graph
- Find Shortest Path
- Display Shortest Distance
D. Finding Shortest Path

Here we have to find the shortest path between two cities and path should be through available bus services. Let’s find between shortest path from depot (source node) to pune (destination node) from available bus network flow graph. We have two paths available. The shortest path from depot to pune is given by Red line in the bus network flow graph. There are other paths available from source to destination nodes but this algorithm finds the best path throughout all possible paths. Bioinformatics Toolbox™ in matlab provides various commands for solving shortest path problem, vehicle routing problem.

Bioinformatics Toolbox™

E. Driver Duty and Bus Service Scheduling:

Here we have implemented driver duty scheduling algorithm in Matlab software where scheduling of up to 5000 drivers can be done. We have to enter the Number of Drivers we want to schedule and enter the start time and end time of each driver as shown in fig.6

The detailed schedule is displayed when all start time and end time of each driver is entered successfully. It contains the number of buses are allocated to different Drivers as shown in fig.7
IV. CONCLUSION

This work has successfully created a graphical user interface for Bus Depots. Since finding the optimization for this problem manually is very tedious task also it requires large computation time. It is possible to solve shortest path problem easily in matlab with Bioinformatics Toolbox™. The Matlab algorithm has proven itself to be a powerful tool for solving strong combinatorial optimization problems like the VRP.

One can consider the problems of routing and scheduling for buses with Multiple depots and problems with more complexity for further research. The implementation of this approach will help in developing feasible environment for public bus transportation.

V. RESULTS

The results were evaluated in terms of shortest route from depot’s node to destination node based on different parameters like distance, cost associated with every service, time required. Also displayed the optimal route, optimal distance, approximate time. The Graphical user interface for bus depots has been developed. Driver duty scheduling and bus service scheduling have been done in Matlab software.

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