**OPTIMIZATION TECHNIQUES AND ALGORITHMS**

**2017-2018**

**"A1-G-2"**

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| **Intelligence Transport Systems**  **The main goal is to synchronize private and public transportation in order to optimize**  **the overall traffic situation in the city.**    **It is an application for transport system comprised of advance**  **information about users, routes and vehicles. It provide you with**  **the traffic info, best routes and public transport schedule.** |
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**GROUP MEMBERS: Submitted To:**

**16UCS059 Dheeraj Agarwal Dr. Jayprakash Kar**

**16UCS061 Diksha Agarwal**

**16UCS094 Kritika Singhal**

**16UCS002 Aakirti Agrawal**

**16UCS078 Hritik Dusad**

**16UCS050 Ateet Tiwari**

**Abstract**

This study uses regression analysis to evaluate long-run traffic management system performance. Intelligent Transport system is an established route to resolve or at least minimize traffic problems.

The issue of traffic management is a big challenge in front of today’s evolving world. There are various schemes and methods introduced by government in order to handle the same.

In this project we have tried to handle this problem using the principles of optimization in order to minimize the traffic by synchronizing public and private transportation system.

**Introduction**

According to the census community of 2011, it was found that 17.9% of growing Indian population is fully depended on public transportation system whereas 35.7% of the population has no option rather than private transportation because of the 2 main issues first one is time and the second one is pollution. With rapid urbanization and growing transportation demand, India is facing great issues of pollution which is in turn caused by the inadequate public transport and rapid motorization. Traffic is the second problem can be said to be caused by mixing of slow and fast vehicles without segregation. Other problem being to be transportation energy demand and carbon emissions rising.

The cause of the problem is poor quality and insufficient capacity of roads, population growing from 4.6 times whereas vehicle number has increased 158 times and having insufficient road space available to public transport.

With this idea in mind, the government is motivating the general authorities for advanced transportation facilities and management. In this project we will be implementing optimization techniques and algorithms such that we can define the public and private transportation for all 2 lakhs users, minimum number of transportation available at time to general public, using transportation such that the pollution realize can be minimized, scheduling public transportation to increase its frequency and decreasing time of traveling and no of public transportation that should be used between 5 am to 11 pm such that public can prefer public transportation rather than private transportation.

**Model 1**

In Jaipur city there are two basic type of on road transportation classified as public and private. Government has provided buses for public transport which can accommodate maximum of 40 passengers at a time on the other hand 4 person can travel in a private vehicle. On a regular day 2 lakhs people need to travel within the city using private as well as public vehicles. Government implemented a policy such that for every 50 private vehicles there is one public vehicle running on the road in order to synchronize the ratio between public and private vehicles. Due to ever increasing vehicles in the city, pollution index of the city is on the rise. On a regular day a bus emits an average of 350 ppm of carbon particles and a private vehicle emits 50 ppm of carbon particles. Due to such increase in pollution for every 100 bus in the city a pollution reducing machine is installed which reduces the quantity of carbon by 10000 ppm in a day. Find the optimum number of private and public vehicles such that pollution produced in a day is minimized. Number of public and private vehicles should not exceed by 1000 and 45000 respectively.

**Objective Function:**

The objective function is to minimize the pollution level in the city caused by vehicles:

**Z(min) = 350\*x + 50\*y - 10000z**

**CONSTRAINTS:**

Let x be the number of public vehicles and y be the number of private vehicles on the road then total passengers using the transportation facility should be greater than 2 lakhs.

For every public vehicle carries 40 passengers at a time and private vehicle carries 4 people,

Therefore, 40\*x + 4\*y >= 200000

For every 50 private vehicle, there runs a public vehicle:

50\*x - y >= 0

Total number of public and private vehicles should not exceed 50,000:

x + y <=50000

Let z be the number of pollution reducing machines installed.

For every 100 public vehicles one such machine is used.

-100z + x >= 0

Also given that (lower bound),

x >= 0 and y >= 0

Pollution caused by one public vehicle is 350 ppm and by private vehicle is 50 ppm.

**Model 2**

Jaipur Government wants to use the minimum number of buses in order to reduce pollution and cost for implementing public transport. For that purpose government planned a new strategy according to which a particular bus has to complete its shift of 6 hours per day. A bus can travel from one place to another in a time period of 3 hours and has to return back to its origin by the next 3 hours.

Buses start running from 5:00 in the morning and end their day by 11:00 pm. This whole schedule is divided into 6 shifts of 3 hours each. In a day minimum of 1,65,000 people travel from bus and each bus can accommodate 40 people.

The buses must satisfy the requirements as shown in the following table.

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| --- | --- |
| Time Slot | Minimum no. of passengers |
| 05:00-08:00 | 5000 |
| 08:00-11:00 | 60000 |
| 11:00-14:00 | 10000 |
| 14:00-17:00 | 30000 |
| 17:00-20:00 | 20000 |
| 20:00-23:00 | 40000 |

**Objective Function:**

We need to optimize the number of buses for the given purpose and hence this is the model of minimization and the objective function will be:

**Z (min) = x1 + x2 + x3 + x4 + x5 + x6**

**CONSTRAINTS:**

Let x1, x2, x3, x4, x5, x6 be the number of buses in the respective time slots given above.

Minimum number of passengers that are travelling in a particular time is given in the table.

Each bus can accommodate 40 passengers and in time slot 1 there are x1 buses,

Therefore 40\*x1 people can travel in slot 1.

40\*x1 >= 5000

In 2nd slot there will be x1 buses returning to their origin and x2 buses going to their destination;

40\*x1 + 40\*x2 >= 60,000

Similarly, for other slots also we can form the constraints as:

40\*x2 + 40\*x3 >= 10,000

40\*x3 + 40\*x4 >= 30,000

40\*x4 + 40\*x5 >= 20,000

40\*x5 + 40\*x6 >= 40,000

**References:**

● AIMMS 3 ombo optimization modelling

● Computational Intractability - Lecture 7 by David Avis

● Linear and nonlinear programming DG luen berger