



ANALYSIS OF EDUCATIONAL TRIPS FOR SELECTED SCHOOLS IN AHMEDABAD

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Abstract: In numerous cities of India including metropolis, auto-rickshaw and van are the main modes of transportation opted by the parents for the school going children. School trips can be considered as a major factor affecting road traffic as most school and office timings are similar. School trips become part of peak hour traffic. The students face the problems due to long travel time and travel distance due to improper scheduling and routing of bus. The situation now is all the nearby schools/colleges send their own contractual buses to even smallest part of the city, and the buses cover the area and locality in a route, which cause huge traffic. There is congestion on roads which result in delay of the trip of the users i.e. students. This paper reports the results of data collected from various educational institutions of Chharodi area of Ahmedabad City to examine the travel characteristic. Bus data collected from various schools in a vicinity of 2 km in Chharodi area of Ahmedabad City and tried to amalgamate their data by proposing a common bus service for these schools. This will reduce the congestion there by decreasing the travel time as well as the travel cost. Bus routes and the number of buses have been estimated based on the study. The proposed co-ordinated bus service is found to be economically viable.

Index Terms - School trip, Environmental pollution, Travel cost, Travel time, Travel distance, Desire line diagram

I. INTRODUCTION:

Population is increasing day by day. Needs of the people are increasing tremendously. There is change in life standards of society. School education pattern is changed. People's standard of living is increased. People tend to travel more from one common junction to another common junction by their own means of transport. Such demands are growing at an exponential rate. More number of vehicles is moving on the road creating a chaos during the peak hours of service. Various classes of people are affected due to the chaos created due to traffic congestion. According to the Census of India-2012, children comprise 39% of the population. Generally, education purpose trips are regular trips which occur daily except holidays and weekend. Hence, school trips can be considered a major factor affecting road traffic because most school and office timings are similar. School trips become part of peak hour traffic. India pose serious traffic issues and risks due to various factors including lack of proper road traffic infrastructure and poor enforcement and lack of lane discipline. Also, in addition to the above scenario, people belonging to middle and low-income groups are highly dependent on motorized two-wheelers, which add to the overall traffic risks of road users. These poor conditions contribute to high road traffic injuries among adolescents.

The travel behaviour of children differs from that of adults. However, the travel mode choices for school trips in developing countries have remain unclear thus far. Most school-going teenagers participate in taking decisions regarding their school travel mode, whereas the school trips of younger children are decided solely by their parents. Usually, these trips are classified as two trips:

- a) Home to School
- b) School to Home.

There are undoubtedly many factors that impact the choice of mode for the children's trips to and from school. Studies of children's school mode choice show the important effects of home-school proximity, household socio-economic attributes, neighbourhood-built environment characteristics, and parental or caregiver perceptions of neighbourhood safety and vehicular traffic conditions on the path to and from school. In order to complete the trips, various factors are examined. Factors such as

1. Age of student /child
2. Income of family
3. Comfort Level
4. Convenience
5. Safety
6. Cost
7. Time
8. Trip-Maker (Parent/Guardian)

Looking upon the above criteria, mode of transport is selected by the trip maker (here: Parent/Guardian). Usually, mass transport vehicular systems are extensively used in India such as Bus, Van, Auto-Rickshaw and recently car-pulling too. Bus services are availed over other transport vehicle has a drawback where it is unable to give door to door service. Vans and auto-rickshaws are able to give door to door service. Van & Auto-Rickshaw service providers can transport less students due to maximum capacity of 10 to 14 children may be accommodated. Van is a protected small vehicle whereas auto-rickshaw is unsheltered vehicle. Auto-rickshaw has a capacity of 3-4 children but service providers fill in at a capacity of 10 which makes it unsafe and uncomfortable for the school going children who are not enough mature. Similarly, van service providers accommodate around 12-14 children instead of 8 which makes it uncomfortable and inconvenient. As the van charges are high in comparison to other modes of transportation, parents/guardians tend to cater their children themselves for the same. As the occupancy of the vehicle is used more than its maximum capacity, both comfort and convenience are not fulfilled. Also, the costs for the same service offered are high in comparison to other services.

Nowadays, there is a systematic development of schools where the school provides a mode of transportation giving pick up and drop services which includes vehicles such as bus, van or may be auto-rickshaw. Some schools in India provide third party transportation services to avail the travelling arrangements whereas some schools have independently started offering transportation facilities. The same have been implemented in various schools in Ahmedabad, Gujarat. Vehicular services are offered to accommodate a total of 30-35 passengers through a mean of bus/mini bus to the students with a sense of safety, comfort and convenience. They provide services at reasonable rates that are affordable by all income groups. The pickup and drop service points are generally categorised according to the frequency of children coming from a particular area. Generally, the pickup points are decided to be near the house or in the vicinity as school going children have to be boarded by the parents/guardians. Also, parental times for pick up and drop to the boarding station increases which may lead to delay in universal delay in the life cycle of human life. Thus, bus has a fixed optimised route in order to achieve the minimum travel time. As the capacity of the bus is more in comparison to the other vehicles, a greater number of stops would be required to achieve the strength. If the number of stops increases, the travel time taken to complete one trip will also increase. Deceleration, stop, Waiting, start and acceleration cycle at each stop will increase travel time for the students. Hence, their pick up time is quiet earlier than school time to reach school in time.

II. NEED OF STUDY:

Nowadays, educational institutes use bus as a mass transportation mode. There are some issues like driver's behaviour, delay in arrival time and departure time, inappropriate routing of buses etc. These are the issues faced by the students as well as children's parents/guardian. The students residing in the vicinity of the institute tend to use private mode of transport like cycle and going by walk as active mode of transportation. Parents start to pick up and drop by two-wheeler and four-wheeler, they are waiting outside school during school end hours. They need for parking space to wait and pick up/drop. This leads to on street parking near school which cause congestion and obstruction to moving traffic. Parents choose mode hired rickshaw and sometime even city bus if bus stop is near school. All the students face the problem due to long travel time and travel distance due to bad scheduling and routing of bus. This also causes congestion on roads which would result in delay the trip of the users.

The situation now is that all the nearby schools/colleges are sending their own buses to smallest part of the city, and the buses cover the all locality, which cause huge traffic. The highest problem faced is of traffic congestion which harms in many ways such as, the most harmful effects of traffic congestion is its impact on the environment also, drivers who encounter unexpected traffic may be late for work or other appointments, causing a loss in productivity for businesses and in the drivers' personal lives and drivers who become impatient may be more likely to drive aggressively or dangerously. This contributes to poor health for those affected by the stress and puts others in danger.

The students living in vicinity of start of bus route is pick up earlier and dropped later. Overall time of travel is increasing stop to stop along route. Routes decided as per cluster of students to be travel in a bus, Hence, start and end time for home is quite longer than school working hours. Students exhaust during bus travel and finding less concentration in study. Parent/Guardian has to come for pick up and drop at suggested location in time to avoid increase in waiting time of bus.

To suggest some remedial measures to solve these problems, this study is carried out and analysis of the educational trips in selected schools in Ahmedabad is taken as study area.

III. STUDY AREA:

Ahmedabad is a former state capital city, with a population of more than 5.6 million and is the fifth largest city among all 497 cities in India (Census of India, 2012). The city has a geographical area of 464.16 km², with a population density of greater than 12,000 people per km². Of the total population, nearly 0.7 million children are aged 5 – 15 years, which can be considered as the school-going age. There are nearly 603 schools in existence at present in Ahmedabad, Gujarat. In this paper discussion, the authors have selected 2 schools from Ahmedabad. They are located in the Chharodi Village near Vaishnodevi Circle in Ahmedabad district. They are located at a distance of under a radius of 2 km on the outskirts of Ahmedabad city. The schools are:

- i. Nirma Vidyavihar
- ii. Hiramani School



Figure 1: Location of Schools in Ahmedabad (Source: Google Earth)

Both the schools offer primary and secondary education facilities from 1st standard to 12th standard. So, the students of almost 6 years to 17 years age group attend the schools. The schools are far from Ahmedabad city which makes it difficult for the students to travel on their own. Both schools have different timings for primary and secondary sections. They provide bus services as the schools are far from the city keeping in mind driving rights are permitted after 18 years with a valid license. Also, the school timings of primary and secondary sections are different having different bus timings. Both schools timing are similar in for primary and secondary sections, bus timings are almost similar. Nirma Vidyavihar and Hiramani School both have a total of 17 routes each, total 34 buses carrying aggregate of 508 students.

IV. METHODOLOGY:

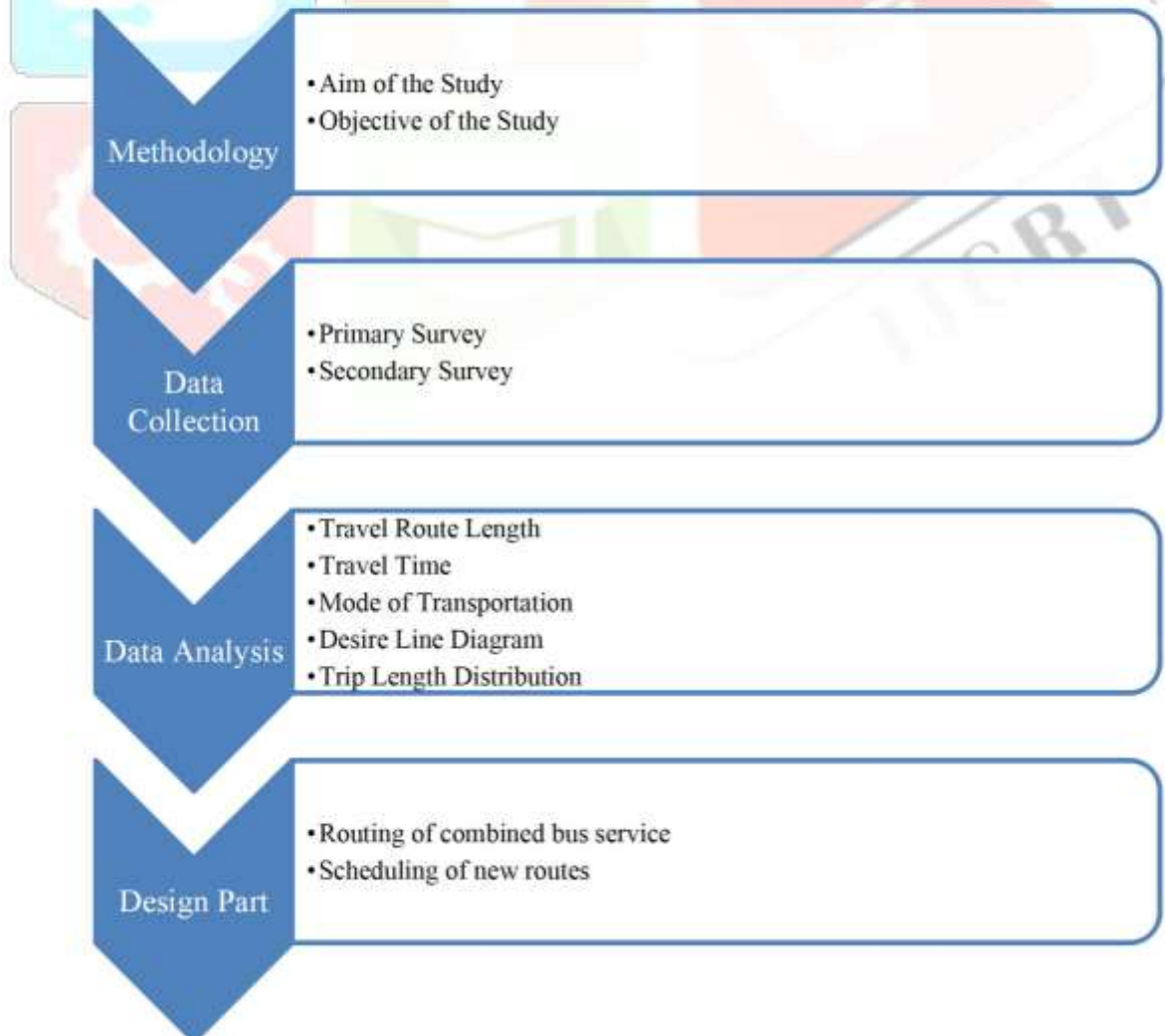


Figure 2: Methodology of the proposed theory

4.1 Data Collection:

Data collection is carried out by personal visit and meeting with school officials for both schools. Data regarding student school trip is collected as follow. There are two methods to collect data as discussed below.

4.1.1 By Interview Method on Entrance of school:

Data collection includes data collection with the help of road side or personal interview. This method is adopted where there are numerous modes of transport available or where there is no facility of bus service in the educational institutions. For this method, we have made Google form for taking data from student and their parents. With the help of this Google form, we can get student's personal data such as name, age, family income; student's travel details and their parents view on current transportation service. So, from this data we can come to know about travel distance of each student, his/her mode of travel, travel time, average travel cost, reason behind that travel mode, etc.

4.1.2 By Interview of bus operator and school officials:

This is a method for direct data collection from school. This method does not include any type of personal interview or surveys. It is adopted in the educational institutions where there is only single mode of transport such as bus service. Data collected for all bus routes, stations in each route and number of students boarding in bus from each station. Because of single mode of transport, it shall be easy to find distribution of students, travel time of each student and travel cost of each student. The only limitation of the method is it can only be adopted in the institutions where there is a single mode of transport which may mostly be a bus service.

Both schools offer bus services as it is the only convenient mode of transport to commute. Data collected data from both the school are as under:

1. No. of students as per standard per bus
2. No. of routes on which buses are running
3. No. of pick up point
4. Route length in km
5. Route Travel Time in min hour
6. Route details

In total, there are 508 students which are catered by 34 buses having an average of 10-14 pickup points per route. The sample data of Nirma Vidyavihar and Hiramani school is shown in the section below in Table 1 & 2 respectively.



Figure 3: Stations of Both School (Source: Google Earth)

Table 1: Data of Route-1 of Nirma Vidyavihar School

Sr. No.	Pick up Point	No of Students
1	Nirma House	2
2	Mithakhali Circle	2
3	Navarangpura	2
4	Swastik Char Rasta	2
5	Commerce Six Road	2
6	Vijay Char Rasta	2
7	Memnagar Fire Station	2
8	Darpan Six Roads	2
9	Jay Mangal	2
10	K K Nagar	2
11	Umiya Hall	2
12	Chandlodiya / Vandematram	3
13	Vishwakarma Mandir	2
14	Godrej Garden	3
15	Nirma Vidyavihar	0

Table 2: Data of Route-1 of Hiramani School

Sr. no.	Pick up stand	No of Students
1	D mart	3
2	Visat Char Rasta	5
3	Ongc Avni Bhavan	2
4	Jantanagar	4
5	Chandkheda Bus Stand	3
6	Satyamev Hospital	2
7	Surya Hope Town	4
8	Shyam Satya	4
9	Gala Haven	3
10	Hiramani School	0

4.2 Data Analysis:

After the data collection, second step is to analyse the collected data such as mode of travel, travel time, travel route length & individual travel length of a student, travel cost, etc.

As shown in flow chart of methodology, analyse the data collected based on mainly 3 points:

- a) Travel mode
- b) Travel route length
- c) Travel time

As per the analysis done on the above parameters, we shall be able to derive desire line diagram and trip length distribution.

4.2.1 Desire Line Diagram:

Desire lines are illustrated on a map to show the flows of passengers/commodity from point to point based on the values from a matrix. From the above data desire line diagram for both the schools have illustrated. With help of data collected about number of students of each area, Desire Line Diagram(DLD) were plotted on Google Earth. DLD for two routes of Hiramani school and Nirma Vidyavihar is as shown in fig.10 and 11. Here, green and blue colour is used to represent Hiramani and Nirma schools respectively. Thickness of each line indicated the routes from home to school as per number of students originated from those stations. Combined desire line diagram of all the routes can have an estimate of number of students coming from each area. Desire line diagram is prepared to know the distribution of students in all the areas of the city. Desire line diagram is useful in making of Origin Destination (OD) matrix. DLD is prepared to know the trip distribution of both the schools from all the areas of the city. Hence, this diagram helps to know that from which area of the city more trips are attracted to both the schools.



Figure 4: DLD Presentation for Hiramani School Trips (Source: Google Earth)



Figure 5: DLD Presentation of Nirma Vidyavihar School Trips (Source: Google Earth)



Figure 6: Procedure of STEP-1



Figure 7: Procedure of STEP-2

4.3 Creating New Common Stations:

There are some common stations which are covered by both the schools in route. Buses of both the schools arrive in same time range at the same station. Which cause traffic congestion and due to that traffic issues arise on the routes in those areas. In order to address the issue, as a recommendation, provide common station for all stations for both schools at a distance around 100 metres range from allotted stations. Suggest the common stations in such a manner which results in easy pick up & drop of the students in less time consuming with economical cost.

All the stations are plotted in Google Earth Software to obtain DLD. DLD provide the number of the students coming from same area of the city. Merge multiple nearby stations to decrease the number of stations for both the schools. Less number of stations minimize the travel distance and travel cost.

In table, we have sample sheet of combined common station between Nirma and Hiramani.

Table 3: Sample Data of New Common Stations

Sr. No.	Stations	School name	Route no.	No. Of students	Common station	Total students
1	Ganesh genesis	Hiramani	5	2	Ganesh genesis	4
	Jagatpur village	Hiramani	16	2		
2	Uma bhavani temple	Hiramani	8	2	Uma bhavani temple	4
	Uma bhavani	Hiramani	14	2		
3	Bhakti nagar	Hiramani	8	3	Bhakti nagar	5
	Hospital	Hiramani	14	1		
	Manikrupa school	Hiramani	8	1		
4	Chandkheda police station	Hiramani	8	1	Chandkheda police station	6
	Life cure hospital	Hiramani	8	2		
	Chandkheda bus stand	Hiramani	1	3		
5	Suryan hope town	Hiramani	1	4	Suryan hope town	6
	Satyamev hospital	Hiramani	1	2		
6	Ioc railway	Hiramani	14	2	Abu nagar	5
	Harsh nagar	Hiramani	14	1		
	Abu nagar	Hiramani	14	2		
7	Sakar english school	Hiramani	8	4	Sakar english school	6
	Swagat bunglow	Hiramani	8	2		
8	S mall	Hiramani	8	2	S mall	4
	Hp petrol pump	Hiramani	8	2		
9	ONGC circle	Hiramani	8	3	Ongc circle	4
	Maitri avane	Hiramani	8	1		
10	Juhapura - 4	Nirma	4	2	Royal akbar icecream	7
	Royal akbar icecream	Hiramani	11	5		

A total of 88 common stations are formed by merging multiple stations of different existing routes of the bus. All the combined stations are then plotted in Google Earth software. Again, DLD of combined stations can be obtained in order to accurate numbers of students coming from particular station.



Figure 8: Common Stations (Source: Google Earth)

4.4 Matrix:

For the above set of data, 3 types of matrix are prepared as input in the program. We have made the following 3 matrices of 88 common stations which we have got between Hiramani and Nirma.

Those 3 matrices are as follows:

1. Distance matrix
2. Time matrix
3. Student number matrix

Table 4: Sample Distance Matrix (Distance in meter)

Station no	Station no		1	2	3
	Places	Lat-long	G. G.	U. B. Temple	B. Nagar
1	Ganesh genesis(G.G.)	23.112936,72.543849	0	4172	6134
2	Uma bhavani temple(U.B.Temple)	23.115718,72.562431	2502	0	1974
3	Bhakti nagar(B.Nagar)	22.265593,70.807852	6134	1974	0
4	Chandkheda police station	23.114935,72.580494	5659	3503	1528
5	Suryan hope town	23.121906,72.576948	4885	2497	1889
6	Abu nagar	23.104908,72.567729	3316	1557	1603
7	Sakar english school	23.104997,72.567483	3284	1525	1571
8	S mall	23.118525,72.605126	10777	6922	6351
9	Ongc circle	23.105815,72.597520	7785	5310	3655
10	Royal akbar icecream	22.993883,72.524364	17205	19304	18084
11	Fatehwadi	22.984182,72.517297	19099	21198	23160
12	Alpha bazar cross road	23.025319,72.559278	11652	12512	13696
13	Anand nagar char rasta	23.075259,72.543417	6727	7698	8826
14	Seema hall	23.013515,72.520117	15414	17513	15611
15	Shyamal char rasta	23.014556,72.529529	14026	14394	14589
16	Falgun tenament	23.020024,72.523249	13983	16082	15021
17	Jodhpur	23.025530,72.527563	13023	13496	13691
18	Chandan party plot	23.079689,72.518172	6033	8132	10093
19	Ramdevnagar char rasta	23.021074,72.512537	12563	14662	16624
20	Mother milk palace	23.035978,72.515460	10701	12800	14762

Table 5: Sample Time Matrix (Time in minute)

Station no.	Station no. Places	Lat-long	1 G. G.	2 U. B.temple	3 B. Nagar
1	Ganesh genesis(G.G.)	23.112936,72.543849	0	11	15
2	Uma bhavani temple(U.B.Temple)	23.115718,72.562431	9	0	5
3	Bhakti nagarBhakti nagar(B.Nagar)	23.112099,72.574033	15	7	0
4	Chandkheda police station	23.114935,72.580494	16	9	5
5	Suryan hope town	23.121906,72.576948	15	7	6
6	Abu nagar	23.104908,72.567729	10	5	4
7	Sakar english school	23.104997,72.567483	10	5	4
8	S mall	23.118525,72.605126	17	14	13
9	Ongc circle	23.105815,72.597520	20	13	10
10	Royal akbar icecream	22.993883,72.524364	35	41	44
11	Fatehwadi	22.984182,72.517297	37	42	46
12	Alpha bazar cross road	23.025319,72.559278	32	31	30
13	Anand nagar char rasta	23.075259,72.543417	18	19	23
14	Seema hall	23.013515,72.520117	30	36	38
15	Shyamal char rasta	23.014556,72.529529	29	34	35
16	Falgun tenament	23.020024,72.523249	30	36	37
17	Jodhpur	23.025530,72.527563	28	33	33
18	Chandan party plot	23.079689,72.518172	12	17	21
19	Ramdevnagar char rasta	23.021074,72.512537	25	30	34
20	Mother milk palace	23.035978,72.515460	21	27	31

Table 6: Sample Student No. Matrix (No. of students)

Station no.	Station no. Places	Lat-long	Student	1 G. G.	2 U. B. Temple	3 B. Nagar
1	Ganesh genesis(G.G.)	23.112936,72.543849	4	4	8	9
2	Uma bhavani temple(U.B.Temple)	23.115718,72.562431	4	8	4	9
3	Bhakti nagarBhakti nagar(B.Nagar)	22.265593,70.807852	5	9	9	5
4	Chandkheda police station	23.114935,72.580494	6	10	10	11
5	Suryan hope town	23.121906,72.576948	6	10	10	11
6	Abu nagar	23.104908,72.567729	5	9	9	10
7	Sakar english school	23.104997,72.567483	6	10	10	11
8	S mall	23.118525,72.605126	4	8	8	9
9	Ongc circle	23.105815,72.597520	4	8	8	9
10	Royal akbar icecream	22.993883,72.524364	7	11	11	12
11	Fatehwadi	22.984182,72.517297	6	10	10	11
12	Alpha bazar cross road	23.025319,72.559278	8	12	12	13
13	Anand nagar char rasta	23.075259,72.543417	9	13	13	14
14	Seema hall	23.013515,72.520117	7	11	11	12
15	Shyamal char rasta	23.014556,72.529529	4	8	8	9
16	Falgun tenament	23.020024,72.523249	4	8	8	9
17	Jodhpur	23.025530,72.527563	8	12	12	13
18	Chandan party plot	23.079689,72.518172	3	7	7	8
19	Ramdevnagar char rasta	23.021074,72.512537	7	11	11	12
20	Mother milk palace	23.035978,72.515460	7	11	11	12

4.5 Coding:

```
# coding: utf-8
# In [39]:
import pandas as pd
import numpy as np
import urllib.request as urllib2
import json
# In [40]:
df_dist = pd.read_excel("Project Matrix.xlsx",index_col=0)
df_time = pd.read_excel("Project Matrix_time.xlsx",index_col=0)
df_time
# In [41]:
def dist_cal(source_lat, source_long, dest_lat, dest_long):
    # source_lat = 23.038755
    # source_long = 72.467644
    # dest_lat = 23.057878
    # dest_long = 72.499564
    url_call =
'https://maps.googleapis.com/maps/api/distancematrix/json?units=metric&origins='+str(source_lat)+' '+str(source_long)+'&destinations='+str(dest_lat)+' '+str(dest_long)+'&key=AIzaSyAzwXUps8jIEuHTnP3FBhPeZ3mIHsCZ-bA'
    response = urllib2.urlopen(url_call)
    data = json.load(response)
    print(data)
    return str(data['rows'][0]['elements'][0]['distance']['value']).split("
")[0],str(data['rows'][0]['elements'][0]['duration']['text']).split("
")[0]
# In [44]:
for i,j in enumerate(df_dist['LAT-LONG']):
    if (i!=0):
        for k,l in enumerate(df_dist['LAT-LONG']):
            if(k!=0):
df_dist.iloc[i,k],df_time.iloc[i,k]=dist_cal(str(j).split(',')[0],str(j).split(',')[1],str(l).split(',')[0],str(l).split(',')[1])
# In[35]:
print(df.iloc[3,3])
# In[45]:
df_dist
# In[46]:
df_dist.to_excel("distance_matrix.xlsx")
df_time.to_excel("time_matrix.xlsx")
```

4.5.1 Output Example - 1:

```
{'destination_addresses': ['19/20, Chandkheda, Ahmedabad, Gujarat 382424, India'], 'origin_addresses': ['P 1001, Ganesh Ginesis, Jagatpur Rd, Gota, Ahmedabad, Gujarat 382481, India'], 'rows': [{'elements': [{'distance': {'text': '4.2 km', 'value': 4172}, 'duration': {'text': '11 mins', 'value': 689}, 'status': 'OK'}]}], 'status': 'OK'}
```

- Here it is observed that origin is “Ganesh Genesis” and the destination is “Chandkheda”. Program will give output of the distance and time of travel between origin and destination.
- Program have given the output as distance = 4.2 Kms. and time = 11 Min.

4.5.2 Output Example - 2:

```
{'destination_addresses': ['D-203, bh. satyamev hospital, Ashtak Elegance, Chandkheda, Ahmedabad, Gujarat 382424, India'], 'origin_addresses': ['P 1001, Ganesh Genesis, Jagatpur Rd, Gota, Ahmedabad, Gujarat 382481, India'], 'rows': [{'elements': [{'distance': {'text': '9.6 km', 'value': 9623}, 'duration': {'text': '15 mins', 'value': 918}, 'status': 'OK'}]}], 'status': 'OK'}
```

- Here it is observed that origin is “Ganesh Genesis” and the destination is “Satyamev Hospital”. Program will give output of the distance and travel time between given origin and destination.
- Program have given output as Distance = 9.6 kms. and Time = 15 Min.

4.6 Grouping of Stations:

Grouping of stations is the vital part of the project. Many parameters had to be taken in account for grouping which would result in scheduling of the buses. Grouping can be done by various parameters depending upon the outcome and state of result.

Now, the discussion is limited to numerous points where most of the preliminary points were considered within permissible limits. The main criteria that were taken into consideration were:

1. Area-wise distribution

2. Minimum trip length
3. Minimum trip time
4. Maximum number of students (35) per bus per route
5. Coverage of Minimum (4) & maximum (6) stations in a route

Here, firstly, area wise stations were distributed which would cater to minimum number of bus to avoid traffic congestion in that particular area. Grouping of common stations in an area takes into consideration the number of students at that particular station.

Table 7 & 8 shows the grouping of route-1 and route -2 respectively. Here, the area wise station grouped which would cater to the maximum number of students at a time in a particular area. Minimum of four stations were included which would group a minimum (22) number of students.

Table 7: Details of Route - 1

Route 1		
Sr no.	Pick up stand	No. of students
1	Uma bhavani temple	4
2	Bhakti nagar	5
3	Chandkheda police station	6
4	Suryan hope town	6
5	Abu nagar	5
	Total no. Of students	26

Table 8: Details of Route - 2

Route 2		
Sr no.	Pick up stand	No. of students
1	Railway colony	4
2	Manki circle	9
3	Sahajanand homes	9
4	Chenpur crossing	5
5	Ganesh genesis	4
	Total no. Of students	31

V. RESULT:

The number of stations has been distributed area wise. The number of stations then grouped according to the number of students and shortest path. The shortest path of all is chosen between the grouped minimum (4) and maximum (6) stations. After grouping of the common stations, on the basis of minimum travel distance and minimum travel time, the stations are arranged in a logical and sequential method. The grouped stations which are considered area wise have been covered with the shortest path available among themselves.

The routing has been done with the help of google maps which gives dynamic data for the same. The least distance travelled by the bus is considered which will cater to maximum of 35 students. In above step we have made 17 groups of stations and as a result we have arranged them in a sequential manner. This sequence follows the rule of minimum travel distance, minimum travel time, maximum no. of student in each bus is 35 and no. of stations covered in each route should not less than 4 and more than 6.

For example, bus – 1 grouped 5 stations, arranging them in sequential manner. Number is given to the stations as per their pickup time. Bus travel from Station No. 1 to 5 and with optimized travel time and travel distance of that route. This way there are 17 optimized routes which have minimum travel time and minimum travel distance. Below are some sample routes as per the above design:

Table 9: Details of New Route - 1

Bus - 1						
Sr. No.	Common station no.	Station name	No of students	Total travel distance	Total travel time	Total students
1	4	Suryan hope town	6	11.5 km	31 min	26
2	5	Uma bhavani temple	6			
3	3	Chandkheda police station	5			
4	6	Abu nagar	5			
5	2	Bhakti nagar	4			

Table 10: Details of New Route - 2

Bus - 2						
Sr. No.	Common station no.	Station name	No of students	Total travel distance	Total travel time	Total students
1	60	Manki circle	9	13.2 km	36 min	31
2	88	Railway colony	4			
3	42	Shahjanand homes	9			
4	39	Chenour crossing	5			
5	1	Ganesh genesis	4			

VI. CONCLUSION:

By providing this common bus service, the travel time for students would decrease there by increasing their productivity. Congestion on road will decrease, which would lead to lower the CO₂ emission. This paper has studied & discussed about two school's mode of transport as a case study. Through comprehensive survey, serviceable amount of sample data from schools was acquired.

After studying & analyzing, Co-ordinated bus mode transport service is suggested. It is observed that travel time & travel distance decreased by **20% & 34%** respectively for the designed routes thereby decreasing the travel costs making it affordable for all parents guardian. Due to decrease in time & distance, the productivity of students/users shall increase. Due to optimized routes, congestion on roads in-turn consumption of fuel will decrease giving a hope about less environmental pollution because of low CO₂ emission.

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