

Real Time Traffic Congestion Analyzer of Dhaka City

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Abstract

Bangladesh is a country which offers so much to life, to live in peace as the people are humble and friendly. But as there is no white paper without black spot, we have problems too. City dwellers of Dhaka city, the capital of Bangladesh always expect a better living life. The main problem that the citizens are always facing is traffic congestion. This research paper will help to find out the possible causes of traffic congestion in Dhaka City and to figure out the possible solutions which provides real time optimal route selection according to the congestion time and distance, computation of traffic congestion and alternative route selection with its congestion time instantly for person who wish to travel in the Dhaka City. It also assists travelers with planning, perception, analyzing and decision making to improve the convenience, safety and efficiency of travel. The proposed system also advances the mobility of the Dhaka City and overcome the drawbacks of existing system.

Keywords: Traffic Congestion, City Dwellers, Route Optimization, Congestion Time, Shortest Path, Real time Traffic, Online Map.

1. INTRODUCTION

Bangladesh is a country which offers so much to life, to live in peace as the people are humble and friendly. Here we all wish to cope with the ever growing world, run like faster than the older. But as there is no white paper without black spot, we have problems too. The problems basically lay in the cities, especially in Dhaka city. There are around Sixteen Million people live in this mega city having an area of 360 square kilometers! Shortage of Power, insufficient water supply, inadequate sewerage facility, pollution we have many problems like these, still if you ask anyone you will find that the biggest problem we face in the capital today is traffic congestion.

Time is the most valuable things in the twenty first century no doubt. And traffic congestion is killing the most productive time of the people of Dhaka city. Time is going on and on and we are lagging behind. The world is becoming speedy where as we are becoming slower. Dhaka city's traffic system is considered to be one of the most chaotic one in the world. The residents are compelled to undergo physical stress and suffer financial losses in terms of man-hours lost on working days. The media, both print and electronic, have been constantly highlighting the sufferings of the commuters in Dhaka city because of the nagging traffic problem. Yet no solution to the problem, apparently, is in sight, at least, in the short and medium terms, though a lot has been said and a big-enough program, undertaken with the assistance from a multilateral lender to improve the traffic situation of the capital city in recent years.

The number of vehicles in Dhaka city is around 7 times the capacity of its roads. According to Bangladesh Road Transport Authority in the year of 2016 in total 81981 vehicles were got registered which means more than 224 vehicles were got registered each day. In last 6 years, the volume of motorized and non-motorized vehicles has almost doubled whereas only a few main intercity roads (Doyaganj to Jurain, Bijoy Sarani to Agargaon and Hatirjheel Begunbari Development Project) have been built in last two decades and many flyovers and roads are under construction [1]. A mega-city like Dhaka should have 25 % of its size dedicated to roads. In Dhaka, Currently, only 7 to 8 percent of its total area is claimed by roads and 3 % of that is meant for public transport and heavy vehicles [2][3]. Having traffic signals in only around 67 junctions among its many streets and roads this very mega city has possessed one of the highest fatality rates in the world. These are the main reasons why we take 2 hours to reach our destination which is actual 20 minute drive. We waste a large portion of our time in roads, get tired and lose money, creating more traffic jam and make us immobile. There is no need to say that it is badly needed to establish such a system which will optimize the problems related the whole traffic system and the respected aspects simultaneously. The proposed system will introduce an internet based, easy and cost effective solution through which a city dweller can instantly choose the right path which will be suitable and saving time and energy.

2. TRANSPORTATION SYSTEM of DHAKA CITY

Without any doubt, it can be said that, the transportation system of a city is the main switch of maintaining order of that city. Good transport system is considered to be the prerequisite of a modern and organized city. But it's a matter of great sorrow that our beloved Dhaka city owns a very poor, defective and troublesome transport system that is making all of the city dwellers' life miserable. But only transportation system alone not responsible for traffic congestion, it is just a consequence of so many limitations of the traffic system of Dhaka city. At present the main transportation mediums that are used in Dhaka city are Public bus, CNG auto rickshaws, Taxis, Private car, Mini Truck, Tempo, Limited Private bus services for the students and employees and Motor cycle. Here is a pictorial view that illustrates the registered vehicles in Dhaka city in 2016.

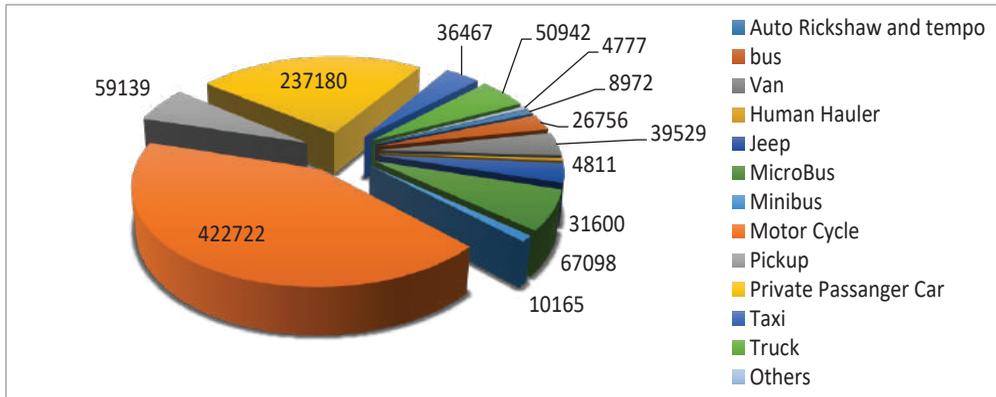


Figure 1: Number of Registered Motor Vehicles in Dhaka –Year 2016 [4]

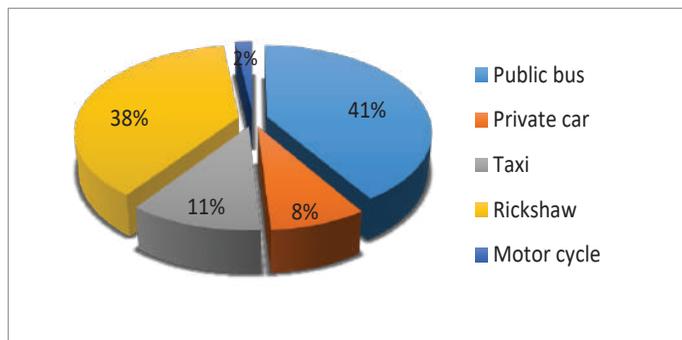


Figure 2: Transportation Medium Used Most in Dhaka City

From Figure 2, we can see that the most used transport is Public bus, which is 41%. After public bus, people use mostly rickshaw. It is very popular transportation in Dhaka City, which is used 38% by people. People use taxi cab or CNG auto rickshaws also but not that much 11%. And only 8% of people use private cars. There are also few bicycle travelers in Dhaka city. We have some wide roads with four lanes as well as we have roads with two lanes. But most of our roads are not wide enough to meet the demand of the population of Dhaka city [5]. According to a report of World Bank in the last 10 years, average traffic speed has dropped from 21 km/hour to 7 km/hour, only slightly above the average walking speed. Congestion in Dhaka eats up 3.2 million working hours per day [2][6][4].

3. POSSIBLE CAUSES of TRAFFIC CONGESTION

The possible causes of traffic congestions can be viewed from General people, Vehicle Operator's and Expert's perspective. Main causes stated by General People are – Traffic rule violation, lack of Planning of city road, Lack of road space, Unplanned stoppage/ parking, Different speed vehicle, Over population, Rickshaw, Insufficient road, Lack of law implementation, Private car, Important establishments in Dhaka and Lack of knowledge in driving. Lack of awareness, not enough space for U turn, not enough traffic police, Presence of hawkers beside the roads, huge number of vehicles in the road and Poor signaling system- Very few people think these reasons are also causing traffic jam [5].

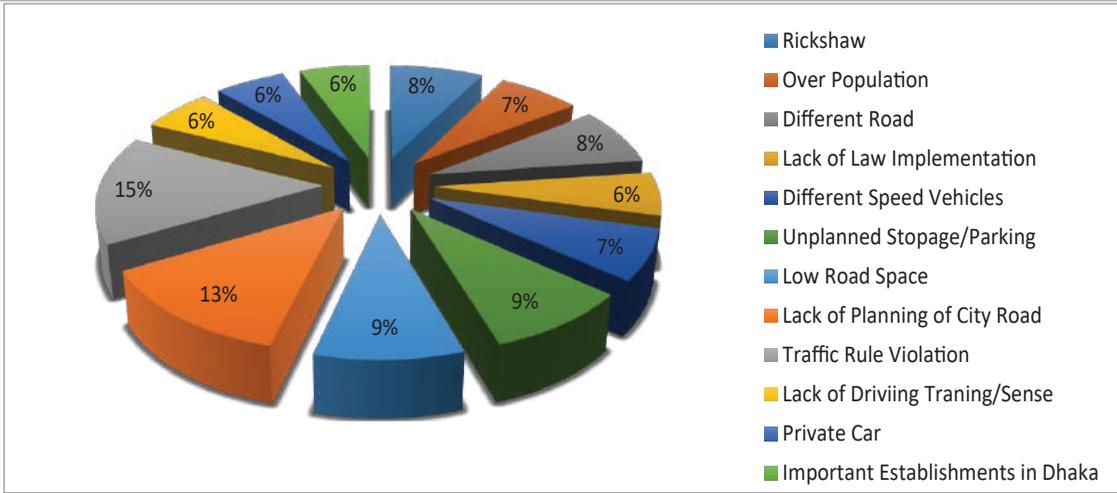


Figure 3: Causes of Traffic Congestion Stated By General People

There are six main causes stated by the vehicle operators, these are-Traffic rules violations, Excessive vehicle on the road, inefficient traffic police, Rickshaw, Reckless driving and Public bus. So, according to vehicle operators, the main cause of traffic jam is traffic rule violation. 25% vehicle operator thinks that. Similarly too many vehicles in road and Problems caused due to inefficient traffic police also highly responsible for traffic jams. They also have stated presence of rickshaw, reckless driving of few drivers and public buses are causing traffic jams [5].

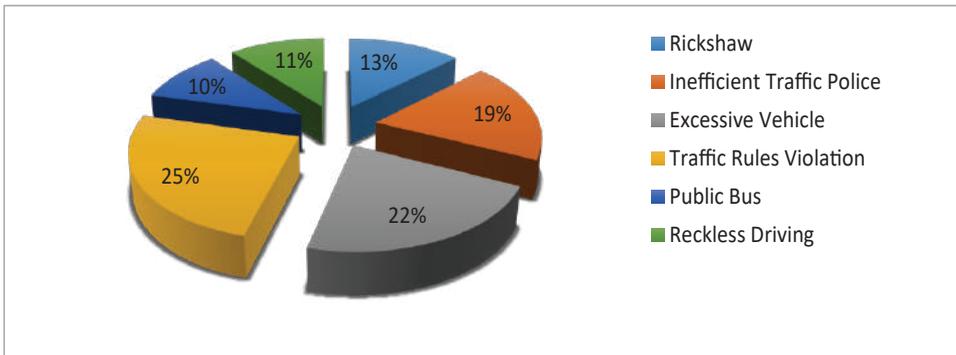


Figure 4: Causes of Traffic Congestion Stated By Vehicles Operators

This is quite interesting that vehicle operators consider public buses are creating traffic jams. They think the drivers of the public buses are reckless and they do not want consider anything. There are also few other causes that vehicle operators think are responsible for causing traffic jams. They are-Parking, U-turn, Poor signaling, Truck and Car parking. From experts' point of view main reasons are – Inadequate road length to Dhaka City, Unplanned City growth, Over population, High migration from rural to urban area, Inadequate traffic management, Lack of Integration, Absence of Mass traffic system, Footpath occupied by hawkers and No Parking policy in Bangladesh[5].

From above discussion the following facts have been found –the number of vehicles several time more than the capacity of city’s road, Around 10 lac Rickshaws are there on the road whereas only 79 thousand of them are registered, Random and unplanned parking, Unplanned urbanization, Intercity bus terminal situated inside the city, No movement of vehicles during random rail crossing signals, Traffic management inefficiency and negligence, Culture of driving on the wrong side, Jaywalking, Insufficient public transport and Excessive presence of private car.

4. IMPACT OF TRAFFIC CONGESTION on DHAKA CITY

The impact of traffic jam on Dhaka City can be viewed in three ways-

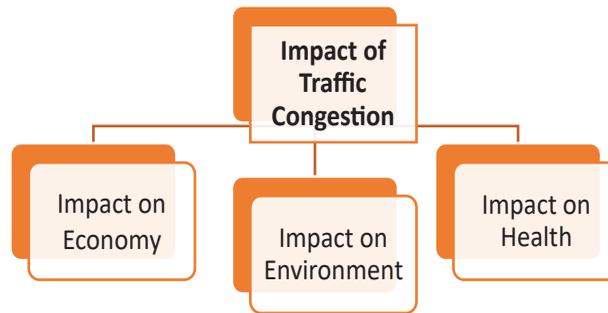


Figure 5: Impact of Traffic Congestion

Due to traffic jam we are losing money in four ways – Losing man-hours, Extra transportation cost, Extra fuel consumptions, Vehicle operating cost and Miscellaneous cost. Impact on health includes Breathing problem, Headache, Mental stress, Hearing problem, unexpected sweating, Tiredness, Eye problem, Suffocation, Respiratory problem, Puking, Heart disease, Fever, Dust allergy, Digestion problem and Dehydration. Impact on environment includes Sound pollution and Air pollution [5]. According to a report of renowned Daily newspaper the cost of Dhaka’s Traffic Congestion is about taka 1.5 billion a day and 550 billion annually and about 3.2 million business hours are lost every day [2].

5. EXISTING SYSTEM

Let’s have a tour to explore the present ongoing system. Government were taken various attempts were including special meeting with the agencies concerned to devise means to help reduce the intensity of traffic problem in Dhaka city. Some tangible improvements were assured within the shortest possible time. But, in fact nothing has happened with the traffic police remaining indifferent, in many cases, to their usual duty. The drivers of buses and trucks and the rickshaw-pullers continue to be as defiant as before. The residents are compelled to undergo physical stress and suffer financial losses in terms of man-hours lost on working days. In the past politicians were often blamed partially for the chaotic traffic because of their alleged involvement in billion-taka toll collection from bus and truck owners and bus terminals. The advisers of the government were believed to be clean in this respect. Yet, there was no improvement in the traffic situation. The Dhaka Transport and Co-ordination Authority provide information to the users about various routes under which bus services are being run. If the users go to the “select your origin” option of the www.dtc.gov.bd and select the desired route then the system will give the details regarding the respected bus services of the selected routes. But the problem is to get the service the users have to be well known about the particular routes which is pretty tough as well as difficult for a regular citizen who is not well known about the various routes of Dhaka city. There is a web site named “www.mydigonto.com” which provides important information same as “Dhaka Transport and Co-ordination Authority”. It shows guideline to choose particular bus service to reach respected destination. The system also suggests two options classifying fastest and shortest route. But here the problem is there is no geographical information. Again it is hard to understand the details of the vehicles information as it is not real time system. Moreover, there is no alternate route suggestion in this system.

The Dhaka North and South City Corporation, according to a published report, has taken an initiative step to move for expansion of the electronic signaling system to 'ease' traffic congestion in the city. In the last 11 years the government spent Tk 37 crore on the traffic signal system in the capital in the last 11 years where in 2004, Tk 14 crore and in 2013 Tk 23 crore for installing countdown timers [7]. A good number of such signaling devices have been out of order more than a year. Both the DNC & DSC are responsible for installation and maintenance of the traffic signaling system and the traffic division of the Dhaka Metropolitan Police (DMP) uses the same for 'smooth' traffic movement. The question is: How effective are the electronic traffic signals? In most traffic intersections having installed traffic signaling system, the on-duty traffic policemen resort to the manual control of vehicular movement, on the plea that the system is ineffective during rush hours. This could be mainly due to the absence of a synchronized operation of the entire electronic traffic signaling system.

We often blame the respected on duty Traffic Police for our suffering through traffic congestion but it is an irony that whereas that much money and government efforts cannot do much, how much can be done by an ill paid minor

officer with his bamboo stick to control a flock of vehicles? There are some FM radio stations in Bangladesh which broadcast their programs to educate, inform, entertain and motivate the listeners. Some radio stations broadcast traffic status in major route after one and half an hour. It is not a real time broadcasting system.

Now, the question is whether these are being followed by everyone or not. Again if we want help regarding this from the police, it is not available as well as suitable always but we need some real time service. If one wants to move from Science laboratory to Bashundhara city shopping mall, suppose, then s/he can't wait for an hour or half an hour to hear the next broadcast from the radio. Again s/he will not call the DMP control room or police station to get the clear direction or know how s/he can manage the time or what should be the best way to take. Will s/he take the Mirpur Road or the green road? Is there any problem in the Sonargaon Road? From above discussion we found some major drawback of Existing System and they are Radio broadcasting facilities are not real time, Signal system is not working in a proper way, no traffic Congestion time calculator, no automated system for Route selection, no such a system that proposed possible route.

6. PROPOSED SYSTEM DESIGN

The Proposed method will provide the traveler three facilities: optimal route selection, computation cost of congestion for a desired route and alternative routes selection. The goal of route planning is to locate a connected sequence of road segments from a current location to a destination. Route computation may be based on criteria such as the shortest travel distance or travel time. In this system shortest route calculation is performed based on Depth-first Search (DFS) algorithm. Route computation is also useful for travel during rush hour, travel in unfamiliar areas,

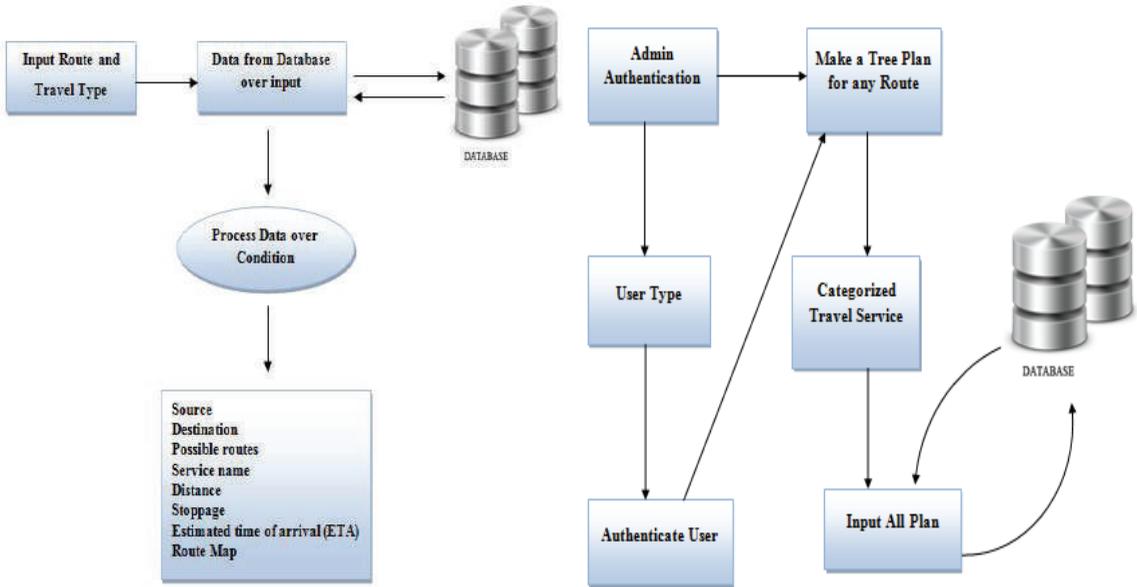


Figure 6: Data Flow Diagram for Normal User (Left) and Admin (Right)

and/or travel to an unfamiliar destination. The goal of route evaluation is to find the attributes of a given route between two points. These attributes may include travel time and traffic congestion information, and thus route evaluation is also useful for selecting travel time by a familiar path. The goal of route display is to effectively communicate the optimal route to the traveler. In this system, the focus is put on algorithms for real-time route computation and computes the shortest distance and also congestion time of every alternate route from travelers' source to destination path of Dhaka City, both statistically and graphically.

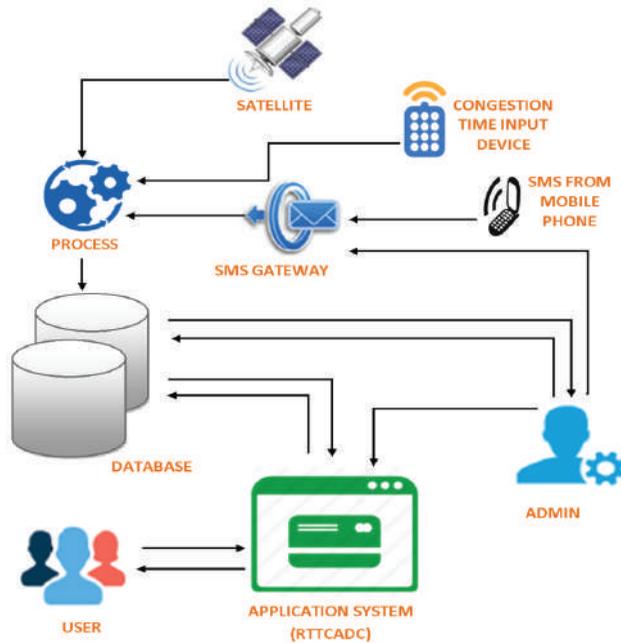


Figure 7: Work Flow Diagram of the Proposed System

7. IMPLEMENTATION

The proposed system RTTCADC (Real Time Traffic Congestion Analyzer of Dhaka City) is designed for the Dhaka city. Now the system implements on a small area of Dhaka city but gradually the system can be implemented to the whole area of the Dhaka city. The RTTCADC is a web based system, the end users will be accessed this by entering the URL in the address bar of a browser, and thus why its installation process is related with the website hosting process. For the convenience of implementation, the source and destination have been chosen in such way that the user can reach from source to destination using two different routes.

Table 1: Signal Time Calculation of Different Routes in Dhaka City

Green road and Mirpur Road is the busiest roads of Dhaka City. These areas are well known and fulfill all the criteria of testing and implementation. Though the countdown timers and signal lights are installed at intersections of these areas, most of them are not working properly. In the peak hour, the on-duty traffic police control the signal system manually.		
Route 01: Science Laboratory Police Box to Square Hospital Limited (1.9 km / 1900 m) using Mirpur Road [7].		
Source to destination	Signal and Crossing Name	Signal Time*
Science Laboratory Police Box to Square Hospital Limited (1.9 km / 1900 m) ^[8]	Science Laboratory Police Box	3 min 50 sec
	Happy Arcade / Dhanmondi road 03	1 min 40 sec
	Dhanmondi Road 06 / Gonoshasthaya Nagar Hospital	-
	Dhanmondi Road 07 / Beximco Pharmaceuticals Ltd.	-
	Kalabagan Mor	-
	Dhanmondi 32 / New Model Degree College	2 min 0 sec
	Total Signal Time	
Route 02: Science Laboratory Police Box to Square Hospital Limited (2.2 km / 2200 m) ^[8] using Green Road.		
Source to destination	Signal and Crossing Name	Signal Time*
Science Laboratory Police Box to Square Hospital Limited (2.2 km / 2200 m) ^[8]	Science Laboratory Police Box	3 min 50 sec
	Happy Arcade/ Dhanmondi road 03	1 min 40 sec
	Green Road Signal Police Box	-
Total signal time		5 min 30 sec 5.5 minutes

* Signal time is effected for the vehicles within range of 20 meters.

Table 2: Calculation of Estimated Time of Arrival

Highest speed in Dhaka is = 40 Kilometer per hour and after Calculation the Default time is = 0.0015 minutes		
Route	01	02
Path Distance	1900 meters	2200 meters
Total Signal Time	7.5 minutes	5.5 minutes
Formula	Total Signal Time in minutes + (Path Distance in meters x Default time in minutes)	
Calculation by the formula	$7.5 + (1900 \times 0.0015)$	$5.5 + (2200 \times 0.0015)$
Estimated time of Arrival	9.6 minutes	8.8 minutes

Here the default time is calculated according to the highest vehicles speed in Dhaka. The speed is, however, much less in many parts of the city. During the peak hour, the speed of the vehicles in Dhaka may fall to less than 10 Kilometer per hour. In that case, the estimated time of arrival may increase and the path that is suggested by the system also changes. From the above calculation, it is found that the distance of 2.2 km or 2200 m can be crossed over within 8.8 minutes. On the other hand, distance of 1.9 km or 1900 meters can be crossed within 9.6 minutes, which mean if one chooses the shortest route it does not mean that one will reach the destination in a shortest possible time. In this case RTTCADC will suggest two routes. The best suggested route will be shown in the top of the suggestion table. User can choose the best route among the suggestion given by the RTTCADC to reach the selected source to destination which will be convenient and time saving.

Front panel interface of RTTCADC is designed in a manner so that the user can easily use the system. Interface color combination and design is designed decently to consider about the user uses. Here tooltip is used to give instruction to the user in need of different segment. When a user will select the source and destination and preferable journey type the system give real time update for both statically and geographically. Here Google map is used to show the graphical information according to system functionality. All data are processed with greater efficiency and accuracy. The signal congestion time from different points sent by the different operators those are authenticated persons. Admin panel interface of RTTCADC is designed in a manner so that the admin can easily use the system. Interface color combination and design is designed decently to consider about the user uses. Here admin is an authenticated person.

8. CONCLUSION

Dhaka City is the Capital of Bangladesh which is now announced as a developing country. It is very important for this city to take vital role in the economy of Bangladesh. But now due to traffic congestion, this city is causing the major loss in the economy of Bangladesh. The City dwellers have become so tired of complaining that it has now become a part of our daily life. By reducing traffic congestion, this city can play a very important role for the country and at the same it can also bring relief and peace for the citizens by ensuring healthy environment, free from noise and pollution for a healthy generation. Lots of plans are drafted and initiated like Dhaka Structure Plan, Bus Rapid Transit, Elevated Express Highway, Circular Embankment-Cum-Road along Periphery, Revised Strategic Transport Plan and so on. Metro rail and elevated expressway – set to gain momentum in the next couple of years. The traffic congestion of Dhaka city is a complex problem, but it has to be solved. Now it is time to work on the basis of long term solution at the same time deal with short term solution to remove current chaotic condition. The proposed system RTTCADC will help to reduce the suffering of the citizens due to traffic congestion and assist to build a strong, economy as well as a healthy, environment friendly and livable Dhaka city.

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