Analysis of traffic congestion and its management in Ludhiana city

A PROJECT REPORT

in partial fulfilment for the award of the degree of

MASTER OF TECHNOLOGY

IN

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CERTIFICATE

This is to certify that **Ashish Singh** under Reg. no. 11307162 has prepared the Dissertation Report Titled "**Analysis of traffic congestion and management in Ludhiana city**" under any direction. This is a bonafide work of the above competitor and has been submitted to me in fractional satisfaction of the prerequisite for the honor of MASTER OF TECHONOLOGY in CIVIL ENGINEERING.

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Signature of student

ASHISH SINGH

DECLERATION

I **ASHISH SINGH** (11307162), hereby declare that the material which I have submitted is my own work and that too is the best of my insight and conviction, all the content it has contains no material beforehand distributed or composed by any other individual or any office. No material in the report which has been acknowledged for reward of any other degree or certificate of the college or any other organization of higher learning with the exception of where due affiliations have been made in the content. It was all arranged and displayed under the direction and supervision of **Mr. Sai kiran** (Assistant Professor).

Date: -

ASHISH SINGH

ABSTRACT

Traffic congestion has now become a very big problem in this modern world. People get stuck in traffic and that causes a lot of unwanted problems. Now, the problem of traffic congestion has become the national focus. Road congestions are seriously affecting people's normal travel, they are restricting the economical development , so this is a serious problem that needs to be solved as soon as possible. With the use of various traffic monitoring system and new technologies, using image and video processing technologies to detect road congestion and is attracting more and more interests. Ludhiana is a city with population over 1.93 million [1] and more population means more vehicles and hence resulting in congestion . Traffic congestion is now a major urban transportation problem. Due to traffic congestion there is a possibility of accidents because of bad traffic management. To cast off road accidents and to store treasured human lifestyles it's far critical to find proper solution for site visitors congestion. In this paper we will identify and study the problems causing traffic congestion problem in Ludhiana city and then propose a proper estimation method and solution for it. Ludhiana being the busiest industrial and industrial centre in Punjab is going through severa issues in site visitors control. In the expression of present inadequacy of substructure facility within the city, the site visitors police is difficult to place guarantees continuity in float of site visitors. The road users must cope with the bullock kart side by facet with the today's era automobiles, main to discordance in traffic waft. To resolve the problem of site visitors congestion to start with we need a right and unique congestion estimation technique. So on this paper we are able to also discuss about range of congestion estimation technique and in the event that they may be used inside the traffic circumstance of Ludhiana metropolis. Recently, many researchers have used GPS records to estimate traffic congestion. However, how to fuse the a couple of statistics fairly and guarantee the accuracy and performance of those methods are still difficult troubles. In this review paper we will look into different efficient traffic congestion estimation methods. We have different methods like image texture analysis which uses grey scale level co-occurrence matrix method (GLCM), there is GPS trace analysis, Multiple data estimation.

Keywords: *congestion, traffic analysis, estimation of congestion , congestion management*

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CHAPTER 1

INTRODUCTION

1.1 General

Cities and site visitors have evolved hand-in-hand for the reason that earliest big human settlements. The same forces that draw inhabitants to congregate in massive town areas moreover cause from time to time insupportable ranges of site traveller's congestion on city streets and thoroughfares. Effective city governance calls for a cautious balancing among the benefits of agglomeration and the dangers of immoderate congestion.

Road visitor's congestion possesses a undertaking for all big and growing metropolis regions. The entire record on which this summary is primarily based objectives to offer policymakers and technical workforce with the strategic vision, conceptual frameworks and steerage on some of the sensible system essential to control congestion in this kind of way as to reduce its normal impact on humans, households, companies and societies.

Traffic congestion is such a condition on shipping community that happens as use increases, and is characterised through slower speeds, longer ride times, and elevated vehicular queueing. When traffic call for is extremely good enough that the interplay among networks slows the rate of site visitors circulate, this bring about some congestion.

As call for follows the potential of roads heavy site visitor's congestion sets in. When vehicles are completely stopped for periods of time, this is popularly called traffic jam or visitors snarl up. Traffic congestion can bring about drivers turning into pissed off and attractive in street rage and injuries. Traffic congestion is commonplace in almost each city location. Mathematically, congestion is normally appeared because the range vehicles that skip thru a factor in a span of time, or a go with the flow. Congestion drift lends itself to precept of fluid dynamics.

Traffic congestion takes place whilst a quantity of visitors or modal cut up generates call for for space extra than the available avenue ability; this factor is usually termed as saturation. There are a number of precise occasions which motive or irritate congestion; most of them lessen the capability of a street at a given factor or over a positive length, or growth the variety of automobiles required for a given volume of human beings or items. About half of the U.S.Traffic congestion is

routine, and is attributed to sheer weight of visitors; maximum of the relaxation is attributed to traffic incidents, avenue paintings and weather occasions.

There is not any single, broadly common definition of visitor's congestion. One of the primary reasons for this lack of consensus is that congestion is each:

• A physical phenomenon regarding the way in which motors hinder every others' progression as call for for confined street area techniques complete capacity.

• A relative phenomenon regarding person expectations vis-à-vis road gadget overall performance. Both operational and user perspectives are crucial in understanding Congestion and its impacts. This report does now not are seeking to choose one method to defining congestion over the alternative; they sincerely both have uses when searching for to expand congestion control techniques. Ideally, city shipping rules have to be advanced on the idea that congestion is related to both.

The difference between road customer's expectancies of the device's standard performance and the way the system truly plays. Urban visitor's congestion must be understood in the wider context of town dynamics and agglomeration advantages. Traffic congestion in city areas is generally the very last outcomes of a hit city economic improvement, employment, housing and cultural, rules that make humans want to stay and paintings quite near every specific and attraction to organizations to revel in the gains in productiveness.

There are many signs that, even though they may now not be thrilled through the threat, City Avenue customers are prepared to stay with crowded roads as long as they derive distinctive blessings from living and operating in their cities. Congestion prevents us from transferring freely and it slows and otherwise disrupts the conduct of industrial agency inside city areas.

However, its miles important to phrase that unfettered movement isn't the number one advantage we derive from living in urban regions. Cities provide get right of entry to an extensive variety of activities, humans, services, objects, markets, opportunities, thoughts and networks. These benefits can be added either via tempo or through extra proximity. Congestion can also have an effect on tour pace but in a few situations, which include dense town cores, congestion may also can be predicted and, to three diploma, regular. In the ones instances, towns have come to accept a

diploma of congestion and preserve to get alongside pretty nicely so long as regular accessibility is excessive

Urban traffic congestion is a huge and developing problem in many elements of the arena. Moreover, as congestion keeps to growth, the traditional approach of "constructing more roads" would not always paintings for a ramification of political, economic, and environmental reasons. In truth, building new roads can virtually compound congestion, in some instances, through inducing extra needs for vehicle journey that speedy devour away the additional potential? Against this backdrop of significant existing and growing congestion site visitors control strategies and information structures are wanted that can substantially boom capacity and enhance site visitors go with the flow efficiency.

Application of ITS generation in regions which include street patron facts and navigation systems, progressed traffic manipulate structures and automobile guidance and manipulate structures has superb capacity for easing traffic congestions.

Traffic congestion and the price of providing mobility are compelling issues to planners, choice makers and contributors of each the enterprise network and most of the people transportation and the diploma of performance with which it's far finished, influences us all. Therefore we're constantly on the lookout for answers to our transportation issues at the manner to supply us not best expanded mobility, but also greater monetary productiveness and a cleaner environment. While new avenue advent can quick relieve congestion within the long term it really encourages further boom in car site visitors through multiplied tour and a transfer a ways from public delivery. Beside this, suitable corridors in our towns for principal roadwork’s is turning into an increasing number of hard, and most of the latest important responsibilities involve turrets to limit environmental disruption and community competition, thereby elevating expenses.

In the beyond decade, a new wave of Intelligent Transport Systems (ITS) has emerged spherical the arena to offer extra equipment to assist remedy our transport troubles. Intelligent Transport Systems can produce major benefits in decreasing congestion, coincidence and environmental affects, and may make large enhancements to the efficiency of commercial and public transport fleets, and to inter-modal integration. ITS also can lessen the need for pricey new delivery infrastructure with the aid of using maximizing the performance of our existing facilities.

1.2 Problem background

Ludhiana is the busiest business & commercial center in Punjab is dealing with several troubles in visitor's control. In the present inadequacy of infrastructure centers in the metropolis, the visitors police is difficult to place ensures continuity in the float of site visitors. The street users should take care of the bullock cart aspect with the aid of facet with cutting-edge technology motors, main to discordance inside the glide of traffic.

Today Ludhiana has become infamous for increasing site visitor's congestion, which has caused variety of avenue accidents, visitor's snarls and jams, frayed nerves and extending adventure to paintings. The valuable lives lost in the street accidents, aren't handiest emotional losses to the family, however additionally represents an financial loss for the country

Fig1.2.1: illegal parking on the road near a shop

Ludhiana has an old road network and now as the number of vehicles has also increased with the increase in the population of the city which has now increased to more than 1.9 million[1] the problem of congestion has increased in a large scale. Being an old city there are advantages of good networking of roads. There are more than one roads that leads to a major landmark destination. This instead of being an advantage still the problem of congestion exists even on each and every road in the city except the industrial area. In the industrial area there are certain timings when people face congestion and traffic jam and those time are morning hours when people leave their home to work in the company or their offices and again it gets a bit congested in the lunch timings that is around 2 pm afternoon and then the major congestion period comes on the evening time and goes along till mid night. The major highways gets congested mostly morning and evening time as they are also constantly getting used by people from outside the city as major highways connect city different cities.

Fig 1.2.2: Long congested traffic jam in Ludhiana city

Ludhiana has emerged no longer best as the maximum industrialized & rich town of Punjab, but also one of the most polluted and congested. It is quite ironic that while the standard of living of residents here has gone up pretty, the great of existence of the human beings right here has suffered a steady decline. Today Ludhiana police has been attempting tough to mobilize finances for site visitors improvement applications from diverse company houses and institutions.

This may be very wholesome fashion as it without delay entails the people inside the development sports in their city.

As a regular visitor of Ludhiana city the main problem I have always faced is congestion in the roads leading to railways station. Though there are more than one roads from Samrala chowk to railway station but still all of them are always congested due to various reasons. The distance from Samrala chowk to railway station Ludhiana is 4 km[2] and still it takes more than 15 to 20 minutes to travel this distance. The reasons behind this congestion is mainly increase in number of vehicles and irregular parking on the roads. The roads from samrala chowk to railways station mainly consist of markets and that is also one of the main reason behind the jams and congestion on that route.

As in the screenshot below of map route of samrala chowk to railway station Ludhiana there are several routes shown to the same destination but with slight difference in the routes and time.

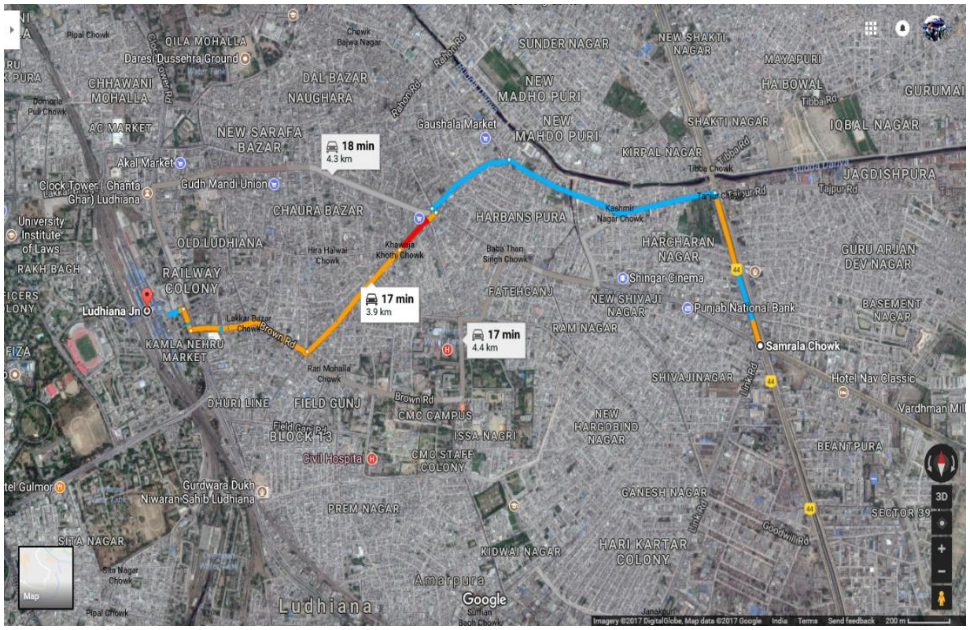


Fig 1.2.3:map showing routes from samrala chowk to railway station

1.3 What is congestion?

There isn't always one single flawlessly established definition of traffic congestion. One of the principle motives for this loss of perfectness is that congestion is each:

• A physical spectacle regarding the manner wherein vehicles hinder every others' headway as demand for inadequate road space methodologies full ability.

• A relative spectacle referring to the user expectations concerning avenue machine performance. Both operational and person viewpoints are essential in information visitors Congestion and its outcomes. This document does not makes a speciality of to choose only one approach to outline visitors congestion over the opposite, they sincerely both have uses whilst in search of to develop congestion control techniques. Ideally, city shipping policies should be evolved on the basis that congestion is related to each:

• The manners of visitors as it nears the bodily capability of the road device.

• The distinction among street users' expectancies of the tool's normal overall performance and how the system in fact performs. Urban site visitors congestion have to be understood inside the wider context of town dynamics and agglomeration benefits. Traffic congestion in metropolis areas is often the final results of a hit urban monetary improvement, employment, and housing and cultural, rules that make people need to stay and paintings significantly close to every other and attract corporations to experience the earnings in productiveness for that reason derived.

There are many signs that, regardless of the reality that they may no longer be pleased thru the hazard, city road customers are organized to live with crowded roads as long as they derive different benefits from dwelling and running of their cities. Congestion prevents us from moving freely and it slows and in any other case disrupts the behavior of industrial organisation inside urban areas. However, it's miles essential to notice that unfettered movement isn't the number one advantage we derive from dwelling in urban areas. Cities provide access to a big variety of sports activities, people, services, objects, markets, opportunities, thoughts and networks. These advantages may be introduced either thru tempo or thru greater proximity.Congestion may additionally have an effect on tour pace but in a few occasions, including dense city cores, congestion may additionally both be anticipated and, to a few degree, established. In those

instances, towns have come to just accept a diploma of congestion and retain to get alongside pretty properly as long as usual accessibility is high.

1.4 Reasons behind traffic congestion

Inadequacy of traffic police: Traffic police in Ludhiana town is insufficient in numbers compared to different mega towns. All the go roads want at least four visitors police at a time while in Ludhiana city it's far seen that the range of traffic police are usually quick and due to the missing of right training the automobiles have become trapped in traffic

Even in the afternoon time when the traffic is at its minimum level the traffic of Ludhiana remains quite congested in compared to other cities, so even in the afternoon time there is need of traffic police in the joints and junctions around the city but due to inadequate amount of traffic officials the problem remains the same.

Fig 1.4.1: Round about at Baba Than singh chowk

This picture was taken around 1pm and the location is baba than singh chowk, the place is said to be first of many congested junctions when we move from samrala chowk to railway station. As

per the survey the junction is properly built up and a proper round about is constructed but still it gets congested because of lack of traffic officials in that area.

Narrow roads: Streets of Ludhiana metropolis are not that extensive unfold, due to unlawful ownership on the street they are getting slender and turning into a purpose at the back of traffic jam. So each possibility is there to make bigger the road as according to their proper of manner to reduce site visitors congestion. Moreover this can be much less high-priced and much less time consuming because of land acquisition won't be required in this manner.

As the streets leading to the railway station are already too much in use and maximum people travel through that area hence instead of the markets which are already there, new markets have been developed by the local people. People with karts and huts have occupied the area of the road and have made it their shops. The illegal possession by the land owners around the road is also a major problem as they have occupied the road and they have constructed shops as the roads have maximum people passing by.

The old shops have already occupied a portion of the roads in front of their shops and they put their goods in front of the shop on the road for displaying and advertising.

Illegal Parking: Illegal parking on the road has been growing congestion each day from samrala chowk to railway station. On-road parking of cars is one of the major reasons in the back of critical traffic congestion on exclusive parts of the Ludhiana metropolis. As the roads approaching the railway station from samrala chowk are all full of many shops and markets, so people visiting those shops park casually and illegally on the road.

The problem of illegal parking is too much that almost one lane of the road is covered with illegally parked vehicles on the roads leading to railway station. The auto rickshaws are often parked on the wrong side and most of the tome instead of using the parking lane along the roads they casually park anywhere on the road blocking half of the road space.

Higher purchasing power: Higher purchasing power of the people of Ludhiana city is also one of the main reasons of congestion in the city. There are families who own more than two vehicles even when there are just two or three people in the family. Being a city which have many industries in it people have become rich and hence there purchasing power has increased rapidly**.**

Due to the higher purchasing power of the people in Ludhiana city people are now opting for private vehicles instead of mass transit but the existing roads are not well enough for the increasing number of vehicles in the city. As a result vehicle congestion is increasing in a high rate.

Improper planning of city development: Development plans always have a long term planning fir the city but here in Ludhiana city the planning is not proper and hence it is also one of the reasons behind the congestion problem of the city. Most of the times it is seen that the road side land is illegally ceased but due to the vague development plan of the city these kind of efforts are going in vain.

Improper lane management: Lane control performs an vital element in the management of visitors within the metropolis and in Ludhiana in most of the places the lane has not been divided because of less width of the road. This additionally consequences to visitors congestion and additionally ends in injuries that too excessive ones**.**

Vehicles try to overtake using opposite lane and this is because there are no dividers between the incoming and outgoing lanes, so the overtaking vehicles do get involved in accidents due to using wrong lane and that is because there is no divider between the incoming and out going lane.

CHAPTER 2

REVIEW LITERATURE

Road traffic congestion in the developing world by Vipin Jain, Ashlesh Sharma & Laxminarayan Subramanian[3]

After reading this research paper I concluded that road traffic congestion is a major problem is most developing nations. Most of the urban areas have very much poorly managed traffic networks with many traffic hot spots or mostly congested areas. In this paper we studied the problem of street site visitors congestion in high congestion hot spot regions in developing areas. This paper consists of use of simple photo processing set of rules to estimate visitors density at a warm spot location using CCTV digital camera feeds. Based inside the analysis of those live digicam feeds and algorithms we show the proof of congestion collapses which generally final for long term intervals. This paper determines the vital road segments while exposed to quick bursts in site visitors on the idea of loose floe site visitors curve. For small congestion regions consisting of visitors warm spot , they've developed a local de congestion protocol that controls the glide of traffic into close to congested regions, subsequently preventing fall apart due to short bursts site visitors. This paper says that is just first step toward a low cost visitors congestion estimation and improvement of low price deployable techniques for congestion in growing areas. What this paper believes is the analysis can be improved by means of using multiple sequential cameras along the highways in addition to localize congestion manage analysis. With the combination photo records the congestion control strategy can truely make an worldwide impact and affect congestion manipulate fairly on a big scale.

Study of road traffic congestion in Hong Kong by transport advisory committee 2014[4]

After reading this paper I concluded that road works are necessary without any doubt and they do create a lot of traffic congestion and traffic jams for the road users. But on the same time development of new roads are important and needed to be done time to time. This is done for sustaining the well-being of our daily lives and hence it is usefull to us. What they have suggested in the paper is a sophisticated XP mechanism that should be put in place to maintain and coordinate the implementation of various road works to minimize the effect of the ongoing development process on the regular traffic or the road users. Continual adaptation of new and improved

technologies was also suggested in the paper saying it will help alleviate the traffic impact of the road development works.

Real time road congestion detection based on image texture analysis by Li Wie[a,*], Dai Hong-ying[b][5]

This paper has proposed a fast detection algorithm for the urban road traffic congestion and this is based on image texture analysis or image processing analysis. What they do in this process is they detect the density of traffic congestion by using the difference in the texture of the congested area image and the unobstructed area image. What the do is they calculate the density of the vehicles by using the image by using an algorithm and this process also contains a human computer interaction area detection technique. This is actually a human computer interaction vehicle area detection. The whole method is carried out by the image through grayscale relegation, gray level co-occurrence matrix calculation and feature attraction , the energy and entropy of this reflects features that is used to detect the density of the area of congestion. The method used in this paper was typically hard but it was quite faster than the commonly used background training method. And the method is also more convenient in selecting the area for the detection of traffic congestion. The paper has proposed a well balanced method of detecting traffic congestion by extracting texture features of an image. This is the first time image texture is used to detect the density of vehicles on the road. The experimental results of this method was quite impressive as well. The results showed that through this method the accuracy could as high as 99% and the speed of the method to calculate the traffic density is quite fast as well. This paper has provided us such a method which is surely very reliable and will definitely provide fast traffic information for road traffic managers if used.

The formula they have used for feature extraction are:

$$S_g(d,\theta) = \sum_{i=0}^{L-1}\sum_{j=0}^{L-1} f(i,j|d,\theta)^2$$

$$S_p(d,\theta) = \left|\sum_{i=0}^{L-1}\sum_{j=0}^{L-1} f(i,j|d,\theta|)\ln f(i,j|d,\theta|)\right|$$

And for the final texture feature S (vehicle density)

$$S = \left(S'_{g0} + S'_{g45} + S'_{g90} + S'_{g135}\right)/4 + \left(S_{p0} + S_{p45} + S_{p90} + S_{p135}\right)/4$$

Detection of traffic congestion and incidents from GPS trace analysis by Eleonora D'Andrea, Francesco Marcelloni[6]

After reading this paper I understood the detection of traffic congestion through GPS data. This paper presents a good system or technique for detecting congestion or any other incident on the road through GPS data that are collected from GPS trackers and smart phones of the drivers on the road. In this method the system assigns every road segment on the map a traffic status or a traffic state. The alert is received from various traffic states and hence it is analysed and a perfect data is carried out which provides the accurate information about various traffic state.

Over all I would like to conclude about this paper is that this paper has provided us a very efficient traffic congestion system through the use of GPS. A gadget for detecting traffic congestion and incidents from real-time GPS lines. The gadget, applied on a Service Oriented Architecture, assigns to every street phase of the metropolis map a traffic country based at the speeds of automobiles, and sends to the customers site visitors indicators , indicating the af- fected place, a traffic nation, e.G., incident, slowed site visitors, blocked traf- fic , and the expected velocity of motors within the vicinity. The system best exploits a actual-time spatiotemporal analysis of the GPS lines and needs no getting to know segment.

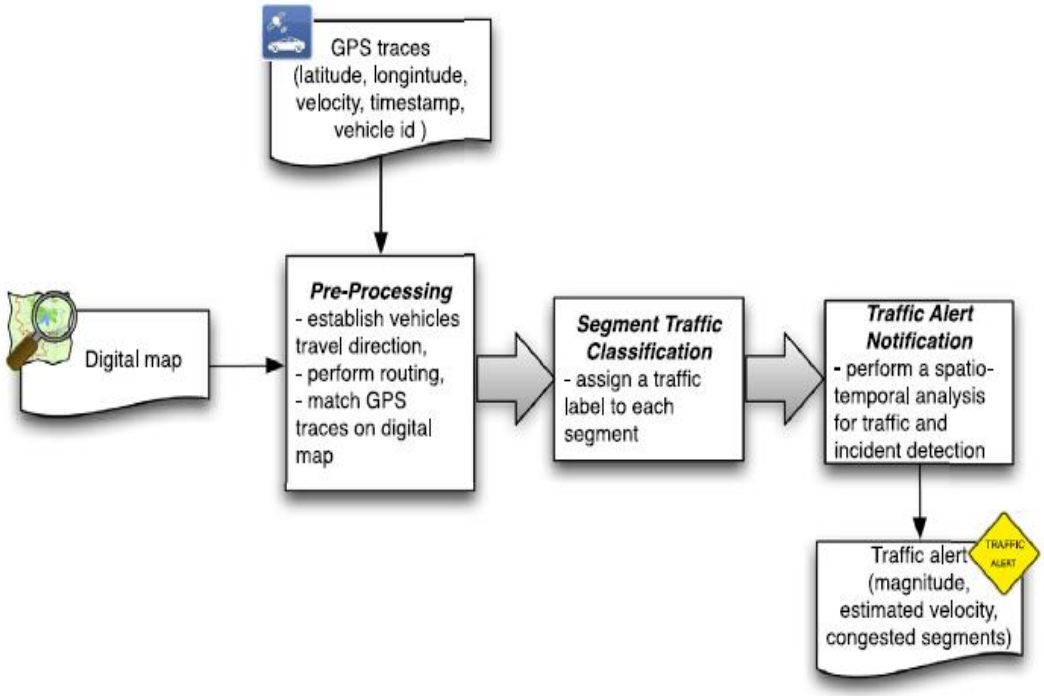


Fig 2.1- structure of detection of traffic congestion and incidents from GPS analysis

Efficient traffic congestion estimation using multiple spatio-temporal properties by Yongjian Yang[a], Yuanbo Xu, Jiayu Han, En Wang[7]

This paper proposes a method of estimating congestion by using GPS data but by some different methods. This paper shows how to fuse multiple data of GPS reasonably and guarantee that the accuracy will still be better than before. This paper shows a method which follows multiple data estimation (MDE)which certainly means that data collected through GPS are used to analyse more than one feature. Like what they have done in this paper is after collecting data from GPS they not only just calculate density of the traffic but also the velocity, inflow and previous status.

Among all the properties calculated by the data traffic inflow and previous status have never been used in previously used method of traffic congestion estimation using GPS data. In this paper to evaluate the method they have applied this method on the large scale taxi GPS data at Beijing and Shanghai. They shown that extensive experiments on these two big cities which have a huge scale congestion, still the method has turned out to be quite accurate and useful.

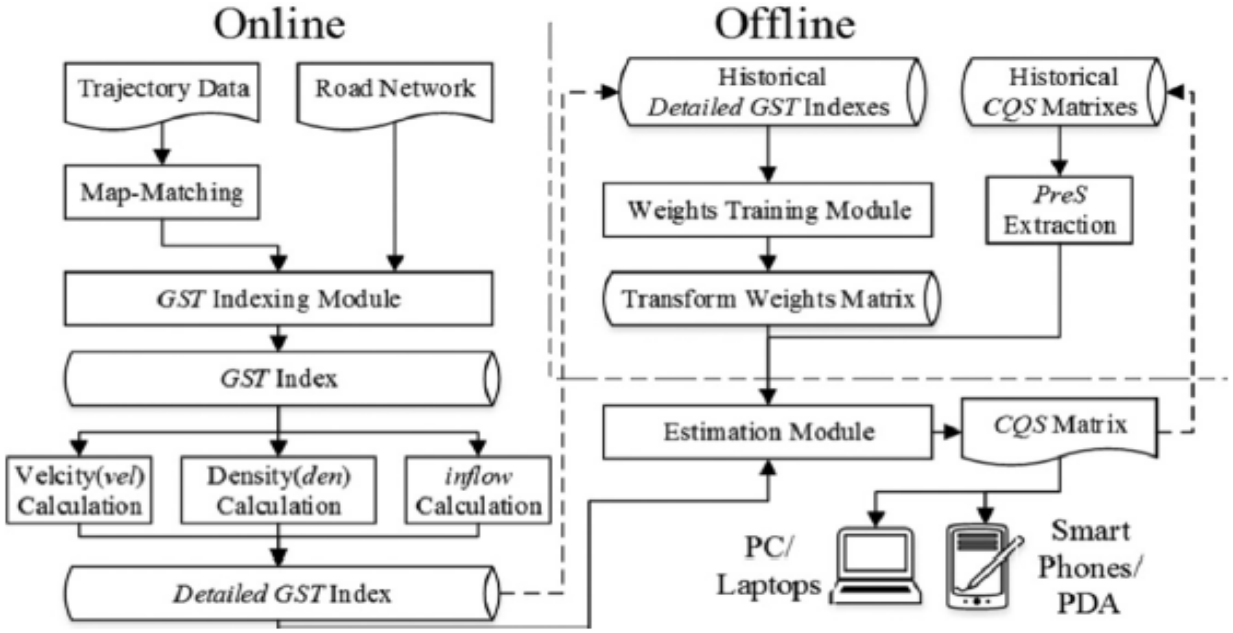


Fig2.2 : Framework of multiple data estimation

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Overview of task

The method used here have to be in right steps as proven under within the following determine to get the first-rate and accurate end result:-

Site survey

The very first step to be done in any type of construction work is site survey. We need to go and get a proper idea of the site and its details. This is done to ensure that whatever the details provided and estimated are correct or not.

Problem identification

Now the second one step is to identify the troubles of the site and seek an answer for that. As the name of the topic suggests in this step we need to identify the problems in the area or the sight we have chosen.

Data collection and Cause of problem

In this step we collect the data required by different methods and surveys or sources. Whatever data is required is collected properly and precisely.

After collection of all the data required the cause of the problem is identified. This step is followed by data analysis and is done to prevent structure from any disaster.

Data Analysis

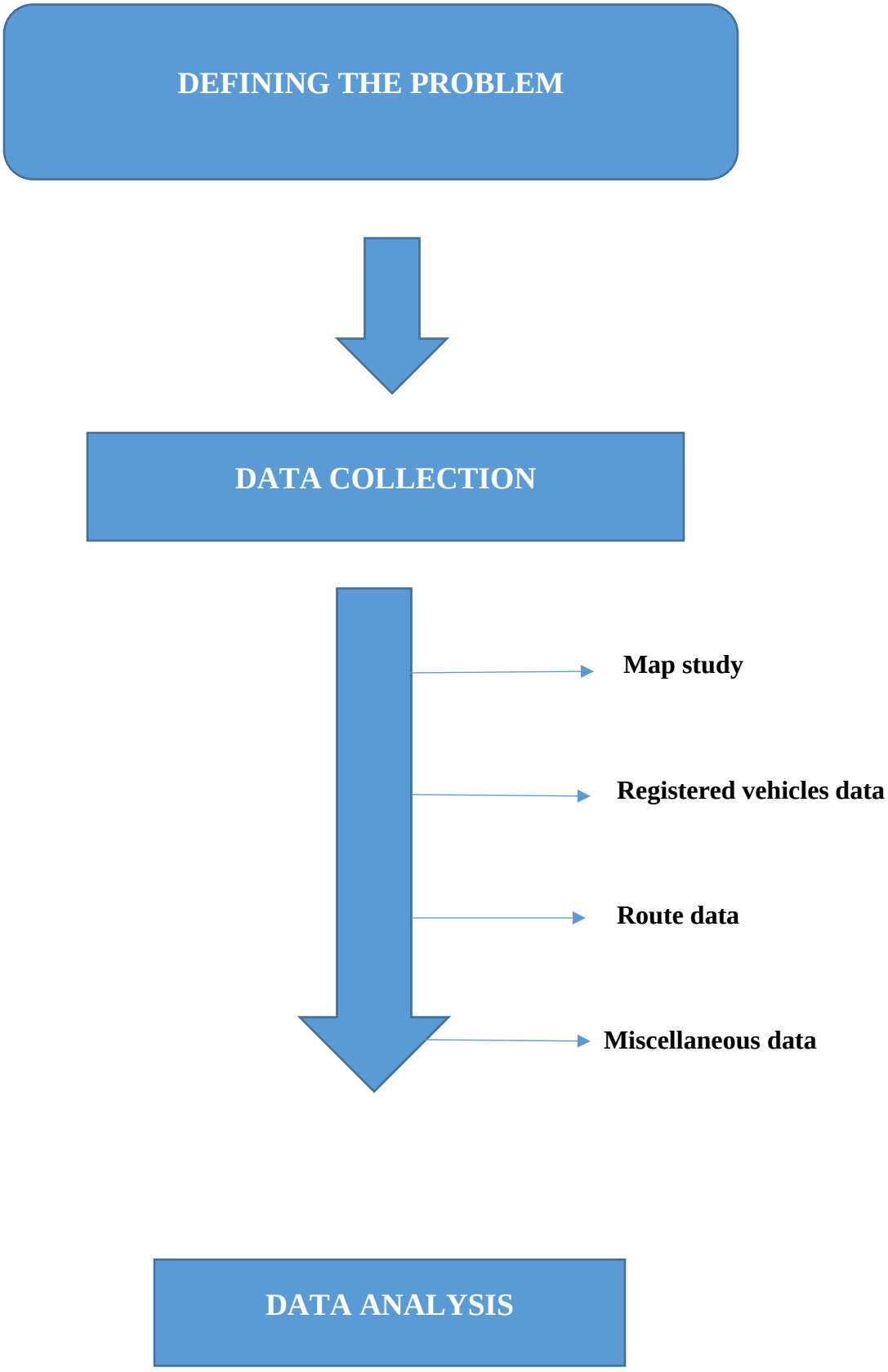
In this step we examine the data which has been accumulated in advance. There are numerous styles of records collections performed at the web page for the advanced construction and to save you the structure from any disaster

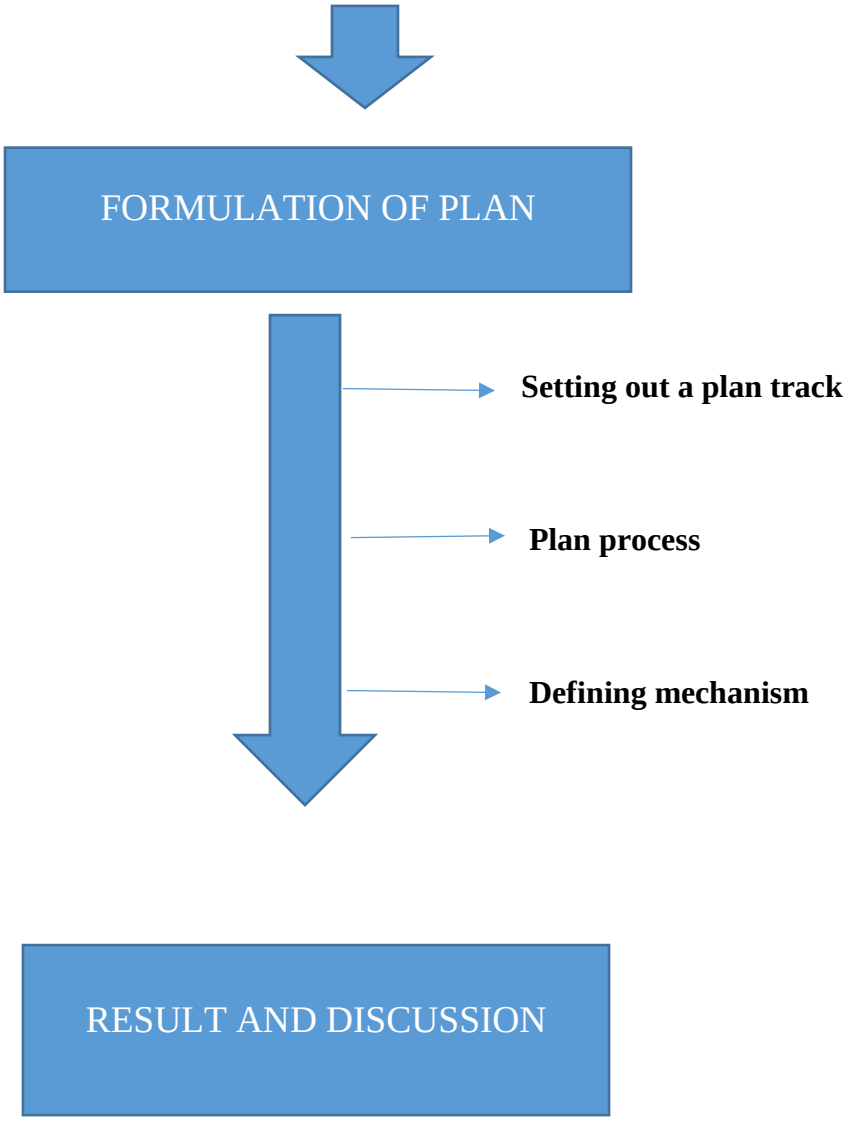
Planning

- Planning is an crucial factor for any paintings. In making plans, each and every step are organized in a serial and are scheduled in a right manner. Planning is a pre proposed work for any structure

going to be made. Planning performs an essential function in any venture for saving time or where there is time restriction. This facilitates in completing the assignment on time.

3.2 Flow Chart of Research Methodology





Explanation of flow chart

So as the above flow chart shows, first of all we have to define the problem as per our prospective. After defining the problem we have to collect data but before that we need to know what data is required for the solution of that problem. We only need the relatable data that can help in resolving

the problem that is in the selected area. So first of all in data collection we need to carefully choose what data is required to resolve the problem we have.

The problem we have is congestion and management of a metropolis so what we need is first of all map of the metropolis, secondly traffic data ie; no of vehicles in the area, types of vehicles, no of mass transit options in that area etc. Then we need route data of that area in terms of map as well to identify the routes which are congested and which are not.

After collection of all the data as required then the analysis is done. The data collected are looked after sincerely and precisely and are analysed as per requirement as well. After the analysation of the data a formulation of plan is done to make a proper way of planning for the problem removal process. Formulation of plan totally depend on the analysation of the data as it makes the data s per the plan.

Then a proper plan track is set out to resolve the problem. All the plan processes are set and a proper mechanism to follow is made up for the future work on the resolution of the problem as per the planning. .

CHAPTER 4

DATA COLLECTION

4.1. Map study and site selection

At first we have to study the map of the city and the route that we are taking for the survey. The city Ludhiana has 368000 hectare[8] of geographical area and as it is an old city of Punjab state it has a good routes of roadways in the city but due to the increase in population the city has become congested and polluted as well.

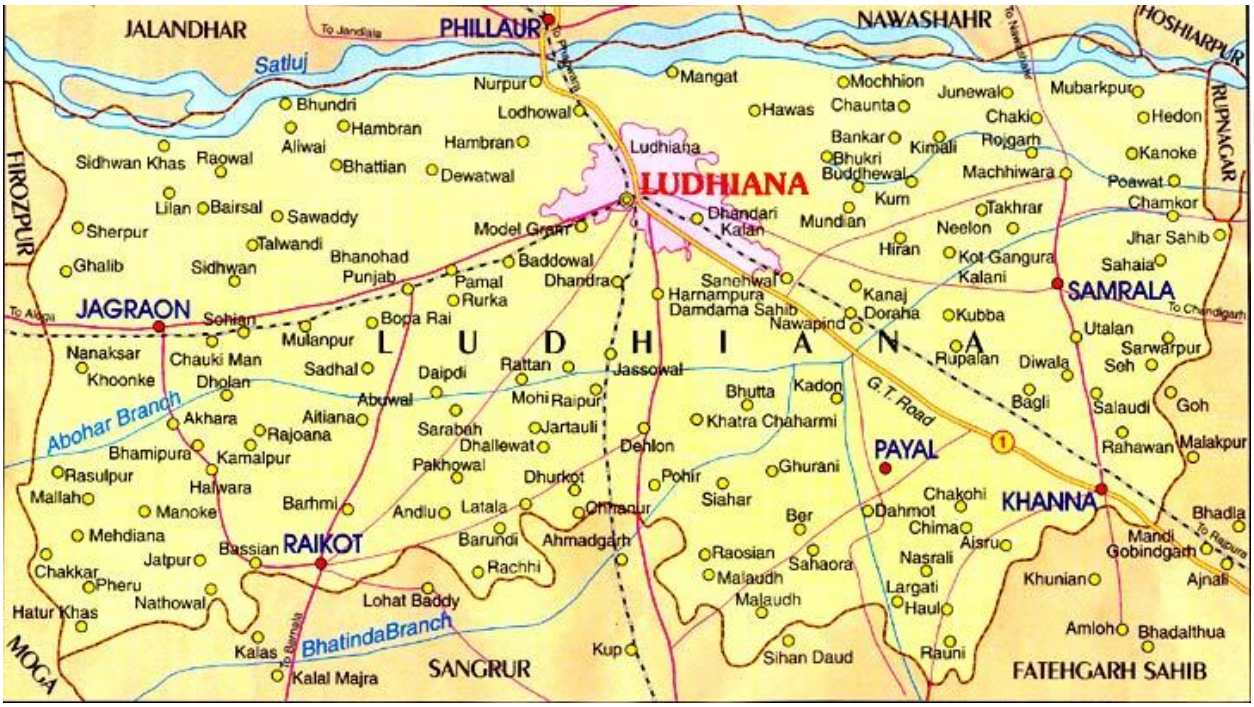


Fig 4.1: road map of Ludhiana district

The topography of Ludhiana metropolis and its surrounding regions is a mean consultant of an alluvial simple and it owes its starting to aggravation artwork of river Satluj. The town is centrally placed in the plain place this is marked for its flatness and featurelessness. The elevation of the town and its surrounding areas tiers from approximately 248.Five meters inside the East to 244.0 meters within the west which means thereby that the gradient of slope from east to west is gentle[9].

4.2. Data of Registered vehicles in Ludhiana

Table 4.2: Registered vehicles in Ludhiana

Type of vehicles	No of vehicle registered
Two wheelers	4729594
Light motor vehicles	66734
Jeeps	63527
Cars	616549
Taxis	18539
Buses	30160
Goods carrier	201758
Miscellaneous	536078
Total	**6262939**

As of 2012, 6262939 vehicles are registered in Ludhiana city [10] and that is also one of the main reasons behind the increase in the congestion in the city making the city traffic hard to manage by the traffic officials.

Fig 4.2: Rush near clock tower

4.3. Miscellaneous Data

Various information has been amassed concerning the visitors congestion trouble in Ludhiana metropolis and especially on clock tower street. The information concerning common velocity, average time of automobiles to attain railway station from Jalandhar skip , period of street phase width of avenue section, causes for delays and congestions has been discovered and are tabulated right here.

Table 4.3: miscellaneous data

Average speed	9 kmph
Average time	20 min
Distance	3.2 km
Population of Ludhiana	1.93 million [1]
Number of registered buses	6291
Four wheelers	31694
Carriage way	10 + 10m
Waiting time for bus	10-15 min

CHATPER 5

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