Design Engineering

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

GIS based study on Impacts of Metro Project on Traffic Management in the city

Pralove Shrivastava
PhD scholar
Department of civil engineering, Sarvepalli Radhakrishnan University, Bhopal (M.P), India

Dr. G. Manikandan
Associate Professor
Department of civil engineering, Sarvepalli Radhakrishnan University, Bhopal (M.P), India

Dr. Kapil Malviya
Associate Professor
Department of civil engineering, Sarvepalli Radhakrishnan University, Bhopal (M.P), India

ABSTRACT

Due to the construction of the Bhopal Metro Project Phase-1 from Subhash Nagar under pass to AIIMS, a good congestion control is necessary for smooth construction and transportation near the among the most important requirements for good congestion control is traffic management and route optimization. This may be accomplished in a variety of ways. This research takes a step towards developing a framework that may contribute to dynamic routing and successful traffic control using a Geographical Information System (GIS). Route optimization entails not just discover the perfect way, and moreover making good use of all routes. Road congestion and several automobiles are commonplace currently, particularly throughout business hours. It is critical to optimize the path, particularly at a certain period. A survey was undertaken in this research on such complete pathways that really are significantly crowded throughout these critical times as well as the network fails to meet its needs. The geographical location is collected using the GPS. The study has also been used to gather information from workers at adjacent firms, such as the amount and path, so an anticipated automobile could be tallied along the pathway. Aerial photographs using satellite were utilized to construct the map-data base and various themed maps. GIS analysis was used to provide alternative pathways to a user based on the aforementioned data.

Keywords: Traffic management, GIS, GPS, Congestion and route optimization.

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

I. INTRODUCTION

Transportation is critical to the development of countries since it is also a requirement of existence but it also had effect on every aspect of human life. As a result, transportation is the lifeblood of a city. Transportation is important to the distribution of material, resources, and individuals, and things as we understand it today would've been impossible without this. Transportation serves as the foundation from economical point of view where the people primarily meets to trade commodities and engages inside the lives of a region throughout the globe. Towns have had an accelerated development rate[1] in recent times, resulting in public transit issues such as road congestion.

For so many places, road congestion is a big issue. Congestions arises when a city's transport systems are unable to handle the amount of traffic; this increases expenses and causes psychologically and physically discomfort. The hectic situation in Bhopal can be seen in practically every hallway leading to the crossroads. Bhopal is among the state's fastest-growing cities. It is customary to assume a significant increase of passenger numbers when localities are quickly increasing. For efficient decision, information from multiple perspectives, including geographical data, is required to reduce the essentials of road congestion as well as its repercussions [2]. Experimental investigations and research on data system design employing GIS connectivity were conducted all over the globe. A novel method of collecting traffic data by GIS technology. At regular intervals, the approach measures the pairings of speeds and longitude-latitude. The new approach is more efficient than the previous method, which required the driver to manually record the data[3][4]. By combining data generated from GIS, it is now feasible to perform intelligent transport tracking. data revealed that the GIS approach is as accurate as the normal manner and is 55% more effective in terms of labor. Road congestion is an issue that affects more than just individual travellers. Environmental stewardship, traffic safety, as well as urban accessibility are all factors that contribute to the effectiveness of living in crowded places. Congestion control can detect collisions and determine the location and severity of traffic congestion. The ability of a GIS system to display and interpret trip data has expanded significantly in recent years as GIS processing speed and usability have improved. As a result, utilizing Geographic Information Systems (GIS) this article will investigate the traffic management system in phase 1 of Bhopal City Centre M.P.

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

Route optimization is one of the most critical prerequisites for effective congestion reduction. This may be done in a number of different ways. This study contributes to the development of a framework for dynamic routing and effective traffic management utilizing a Geographical Information System (GIS). Route optimization comprises not just finding the best route, but also making the most use of all available options. Congestion and many autos are becoming normal, especially during office hours. It is crucial to optimize the journey, especially within a certain time period. In this study, a survey was conducted on such full paths that are highly packed during these important periods, and the network fails to satisfy its demands[5]. The GPS is used to capture the geographical region. The research has also been used to collect data from employees at neighbouring businesses, such as the quantity and route, so that an expected car may be counted along the route. The map-data base and numerous themed maps were created from aerial pictures taken using a satellite. Based on the aforementioned data, GIS analysis was utilized to propose alternate routes to a motorist.The current system of traffic road regulation causes significant congestion problems, extended waiting times, and increased air contamination. In addition, the growth of roads and Bhopal-metro lines in cities is a source of worry. As a result, room for a Bhopal-Metro line on or above the roadway is indeed a thing to keep in mind. This analysis is essential to properly avoid congestion while keeping a future vision for roadways in mind.

II. LITERATURE REVIEW

[6] This study describes a Geographic information system decision - making framework for adaptive traffic modelling and quickest distance planning in TCL. Using exact spatiotemporal resolution, the algorithm controls the aggregate scheduled departure and shortest path required for a shipment to reach at its destination by a specific deadline Time-critical logistics (TCL) consists of actions that should be done within a given period of time, such as procurement, processing, and delivery. These logistic systems' transportation networks constitute a conundrum. The GIS provides exceptional decision support with its data implementation strategies, graphical user, and geographic mapping.

[7] The functional department and capabilities of a small transportation system are included in this original study structure, which is built on element GIS. Conventional electronic mapping operations, fundamental traffic updates management and inquiry, and information sharing with the other transport networks are all elements, which is an inherent part of ITS.

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

The findings imply that such a strategy has a considerable influence on traffic control agents' effectiveness and decision-making ability.

[8] Sophisticated traffic data service platforms help car drivers in seeking to avoid traffic congestion and lowering car crashes by providing rapid and reliable traffic updates to vehicular management staff, enabling them to acclimate the vehicular control systems to a wide range of traffic situation and transportation infrastructure capabilities. But at the other hand, preexisting dynamic traffic information is made accessible to a broad audience. In terms of improving the cooperation and communication among service suppliers and tourists in order to develop a good best route, researchers explore a vibrant traffic data progress item - based collaborative inter methods that rely on the Geographic information spatial analysis prototype as well as the hypothesis of multi-agent. The exploratory system design is then created and developed utilizing the swarm platform and Java programming language, and it produces some data and analysis.

[9] This paper briefly discusses the current traffic situation in China as well as the evolution of smart transportation multimodal data systems. Following that, the principles of a Geographic information system metropolitan smart traffic system are discussed. Finally, the possibility of creating a GIS-based adaptive traffic exchanging digital multimedia system in an urban setting is studied. The GIS-based urban smart traffic shared data platform's system structure and basic functions, and the primary techniques for applying GIS inside the city traffic shared knowledge system, are given. The application of Geographic information system (gis in the construction of urban transport systems that exchange multimedia data is discussed systematically in this paper.

[10] Routing analysis and management related activities in the product lifecycle of an airfield. A clear view of the path is the cornerstone of analysis and management. The transition of the airports reference frame to the reference frame, and the selection of the projection reference frame, are investigated using multiple paths and GIS platform characteristics. In order to meet the demands of display and analysis, the path is fragmented, path segmentation model, and connected with Geographical information system (gis to complete based on the framework of the route visualisation and control process.

[11] Advances in Geographic Information System (GIS) technology and Artificial Intelligence have enabled the creation of Decision Support Systems (DSS) and Spatial Decision Support Systems (SDSS) to address complex real-world situations (AI). This

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

software program assesses if the anticipated GIS routes are acceptable and makes fiber route suggestions. In this essay, we have provided a solution to the problem we faced throughout the above-mentioned project execution. Researchers have developed an algorithmic approach based on the C4.5 Decision Tree Machine Learning Algorithm. Before producing rules, this software system learn from human input. These recommendations are used by the optical network fiber planning software system to allow fiber design via GIS. This method finds the best probable path from a set of routes identified from many GIS data sources using deep learning.

All of the preceding research, as well as other research, point to a growing need for solutions that really can aid in successful congestion control and route planning. The research had presented a method to recommend a path to everyday employees of a certain route based on the arrival and stop time of a railway at a local station, taking into account the situations and suggestions from the aforementioned literature review.

III. METHODOLOGY

Due to the construction of the Bhopal Metro Project Phase-1 from Subhash Nagar under pass to AIIMS, a good congestion control is necessary for smooth construction and transportation near the among the most important requirements for good congestion control is traffic management and route optimization. Bhopal is among the state's fastest-growing cities. It is customary to assume a significant increase of passenger numbers when localities are quickly increasing. For efficient decision, information from multiple perspectives, including geographical data, is required to reduce the essentials of road congestion as well as its repercussion. The research used descriptive resources as well as technique:

- Establishment of a data base
- Detection of crowded pathways
- Staff information gathering from several methods.
- Geographic Information Systems (GIS)
- Identifying alternative paths

The basis network is designed using satellite imagery and roadside Cameras. A preliminary survey too was carried out with the goal of locating high-congestion areas. According to the

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

poll, two places from all across Bhopal were examined, specifically MP Nagar and Habibganj, because these two sites feature banks, restaurants, peer instruction, and all of the big markets, all of which produce traffic, during crowd hours.Bhopal is known as the state capital of Madhya Pradesh. Known as the "City of Lakes." The city is known across the world for its bodies of water as well as scenic wonders, which encompass an area of 2,772 square kilometers. [1]. Figure 1 depicts the Bhopal Phase-1 Route. The DPR (Detailed Project Report) for Bhopal Metro Phase 1 with 27.87 km of lines was authorized by the state government in December 2016 and the Central Government's cabinet in October 2018. By road and rail, the distance between Habibganj station and MP nagar is 2 kilometers. Figure 2 shows a map of the route. Both elevated and subterranean Metro lines are currently being built. Because of the station's existence, the route may get quite congested at times owing to construction activity. As a result, traffic from Subhash Nagar to AIMMS is very congested.

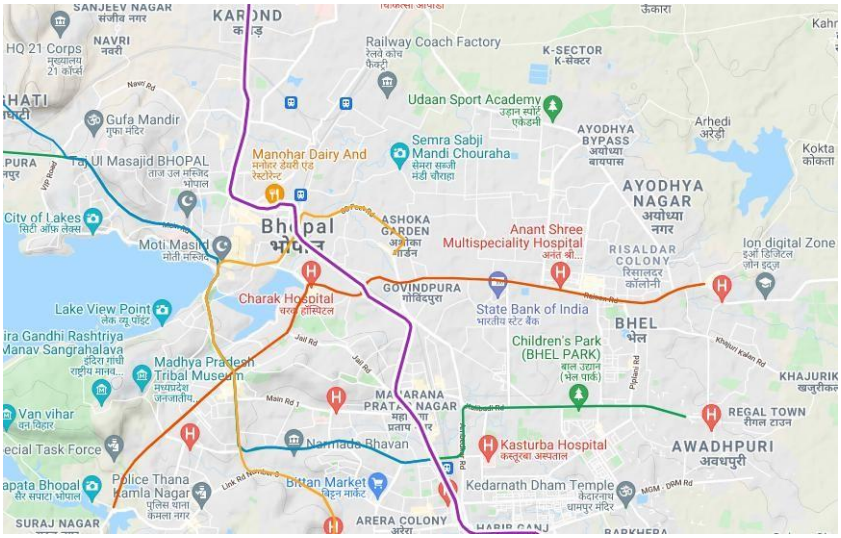


Fig-1 Bhopal Phase-1 Metro route Map.

Data Acquisition

It consists of detailed study of a region to determine its state in congestion, population, and other elements of data gathering. The survey lasted 24 hours in the specified region. On the road, there is a lot of freedom in the traffic density. Using a portable device. Position mapping may be used to collect GPS positions. The data obtained by GPS is sent into the GIS system. The number of vehicles has been measured at two distinct places using CCTV monitoring equipment. Vehicles are divided into three categories: two-wheelers, three-

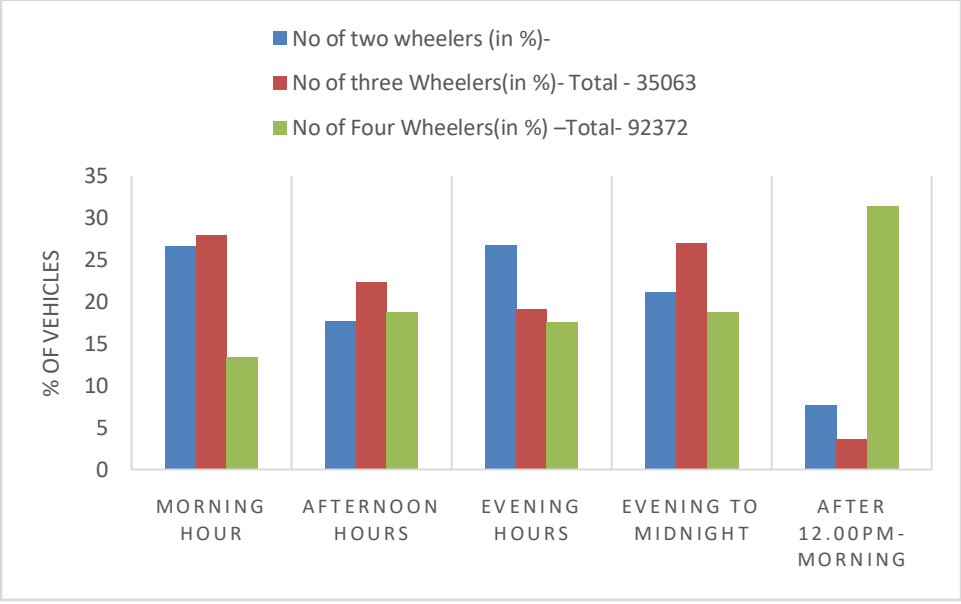
ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

wheelers, and four-wheelers. On September 17, 2021, the traffic size was calculated, and the data is displayed in the chart beneath.

Table 1 Volume of the Traffic at Construction Site

Time	No of two wheelers (in %)- Total- 215293	No of three Wheelers(in %)- Total - 35063	No of Four Wheelers(in %)– Total- 92372
Morning Hour	26.58749	27.94969	13.40233
Afternoon Hours	17.76277	22.38827	18.73187
Evening Hours	26.76957	19.07994	17.63413
Evening to Midnight	21.19623	26.98856	18.79357
After 12.00PM-Morning	7.683947	3.593532	31.4381

From the above table it is clear that at working hours the no. of vehicles near construction site is maximum.



Proposed Route

Because the amount of the information and results of this research are dependent on the position of cars, it is assumed that spatial analysis would be the most efficient method of obtaining the study' results. Furthermore, the goal of doing a geographical analysis is to collect data on traffic density, which has now been incorporated in a Geographic information

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

system as an input. It has a critical function to play in good traffic management. Three alternate pathways have indeed been identified depending on the outcomes of the GIS study, and traffic has been redirected in those areas. The planned route is a departure from the norm for workers who go to work every day. Consumers who follow the study's recommendation and results may leave work on time to avoid gridlock caused by train departures and stopping at the terminal. Predicting a path based on railway halts and departure times is critical for urban planning, particularly in the following areas

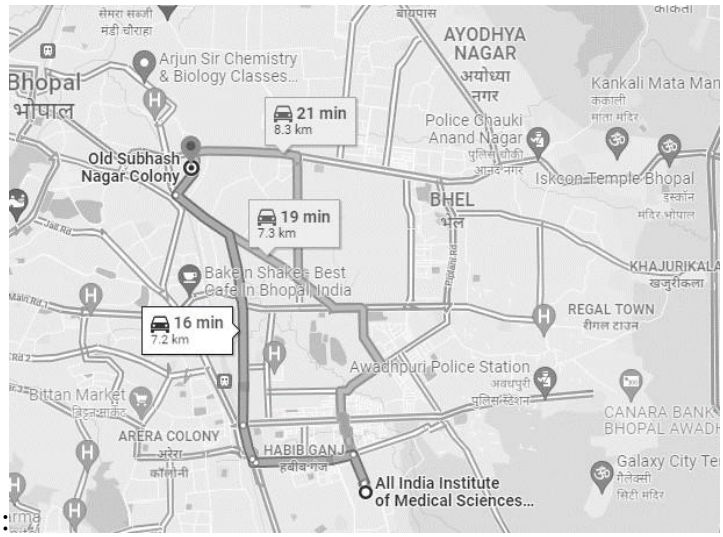


Fig. 3 Proposed route 1.

Fig. 4 Proposed route 2

IV. CONCLUSION

The necessity for appropriate and efficient congestion control has been identified, and this research was conducted with this in mind in order to alleviate the problem. The research's

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

main goal is to optimize routes utilizing a Geographic information system and data collected by a GIS analysis for traffic management due to ongoing Bhopal Metro Phase-I Project. The information gathered had been in the format of geographic location. Our research has shown the greatest results for alternate route suggestions to area everyday employees, since it reduces lengthy wait times. The nod in favour of the recommended alternative route being approved. In the future, the research might be expanded to include additional routes and suggest route separation among the residents of the affected region.

References

[1] Mahabir R, Crooks A, Croitoru A and Agouris P 2016 The study of slums as social and physical constructs : challenges and emerging research opportunities Reg. Stud. Reg. Sci. 3 399–419

[2] A H Ashara et al 2020, “Traffic Management System in Abuja City Center, using Geographic Information Systems (GIS) and Global Positioning System (GPS). A case study of FCT, Nigeria”, Journal of Physics: Conference Series, 1529 (2020) 052068, doi:10.1088/1742-6596/1529/5/052068

[3]Aliniai K, Yarahmadi A, Zarin JZ, Yarahmadi H, Lak SB (2015) Parking lot site selection: an opening gate towards sustainable gis-based urban traffic management. J Indian Soc Remote Sens 43(4):801–813.

[4]Grant-Muller SM, Gal-Tzur A, Minkov E, Nocera S (2015) Enhancing transport data collection through social media sources: methods, challenges and opportunities for textual data. Iet Intel TranspSyst 9(4):407–417.

[5]Xi Chen. Low altitude opening’s effects on air traffic control and countermeasure analyses[J]. Technological Innovations and Applications, 2016,12·87

[6] H. J. Miller, Yi-Hwa Wu and Ming-Chih Hung, "GIS-based dynamic traffic congestion modeling to support time-critical logistics," Proceedings of the 32nd Annual Hawaii International Conference on Systems Sciences. 1999. HICSS-32. Abstracts and CD-ROM of Full Papers, 1999, pp. 9 pp.-, doi: 10.1109/HICSS.1999.772611.

[7] Xiao Juan and Ye Feng, "A study on the framework of GIS-based basic traffic management system," 2010 Chinese Control and Decision Conference, 2010, pp. 4441-4445, doi: 10.1109/CCDC.2010.5498342.

ISSN: 0011-9342 | Year 2021
Issue: 8 | Pages: 10909 - 10918

[8]Jianqin Zhang, Zhijie Xu and Yanmin Wang, "An intelligent traffic information service system based on agent and GIS-T," 2010 International Conference on Mechanic Automation and Control Engineering, 2010, pp. 2791-2794, doi: 10.1109/MACE.2010.5536501.

[9] C. Ding, Y. Chen and Y. Chen, "Construction of Urban Intelligent Traffic Sharing Information Platform Based on GIS," 2020 5th International Conference on Electromechanical Control Technology and Transportation (ICECTT), 2020, pp. 579-584, doi: 10.1109/ICECTT50890.2020.00132.

[10] X. Zhang, H. Yan and Y. Kong, "Study on airport route planning and management based on GIS," 2017 3rd IEEE International Conference on Computer and Communications (ICCC), 2017, pp. 1000-1003, doi: 10.1109/CompComm.2017.8322693.

[11] P. K. Dalela, P. Bansal, A. Yadav, S. Majumdar, A. Yadav and V. Tyagi, "C4.5 Decision Tree Machine Learning Algorithm Based GIS Route Identification," 2018 Tenth International Conference on Ubiquitous and Future Networks (ICUFN), 2018, pp. 213-218, doi: 10.1109/ICUFN.2018.8436994.