Analysis of road network in visakhapatnam city using geographical information systems

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Abstract

The work "analysis of road network using GIS" is carried out with an idea to connect major roads in Visakhapatnam in the shortest path possible. The required data has been collected from Google Earth, geo referenced in ERDAS and represented using ARC-GIS applications. Major roads networks in Visakhapatnam have been Identified and digitized. They have been classified, major junctions and landmarks are represented. The shortest path between any two points within the road network is determined using GIS. The work also can be extended to generate a traffic control mechanism provide many solutions to develop fastest route, new service area and closest facility etc.

Keywords: Shortest Path; GIS; ERDAS; ARC-GIS; New Service area; Closest facility.

Abbreviations: GIS-Geographic Information System; ERDAS-Earth Resources Data Analysis System; IT-Information technology.

Introduction

Fig.1. Visakhapatnam location in India, Coordinates 17° 41′ 18.16″ N, 83° 13′ 7.53 ″ E, Former Name-Waltair, Country-India, Altitudep-18 meters, Time Zone-IST (UTC +5:30)

Visakhapatnam city is home to several state owned heavy industries, has one of the country's largest ports, and its oldest shipyard. It has the only natural harbour on the Eastern Coast of India (Fig.1). Andhra University, a prominent seat of education in Andhra Pradesh, is located here. Visakhapatnam is primarily an industrial city apart from being a tourist destination. It draws tourists to its un-spoilt beaches, nearby scenic Araku Valley and Borra Caves, the 11th century Simhachalam temple, and ancient Buddhist sites spread across the area. The city boasts a submarine museum the first of its kind in the South East Asia, at Rama Krishna Beach.

The city registered over 100% growth in the IT sector over the last year, contributing millions of dollars to the economy. The city has 102 small and medium software and call centre units, of which about 10 units started their operations during the year 2005–07 (Atsuyuki Okabe et al., 2006; Nicholls, 2001). Some IT companies started already are Mahindra Satyam, Kenexa, Infotech, Softsol, and Miracle Software. Wipro has finished

construction of its campus and is about to start operations. Recently IBM has started a new branch office in Vizag as on 2011. Due its rapid development, the road infrastructure has been increased to connect various places in the city. This work aims at finding out shortest path between any two points within the study area using GIS (Armstrong, 1994; Aspinall and Pearson, 2000; Alexis Comber, 2008; Jianjun Zhang *et al*., 2000).
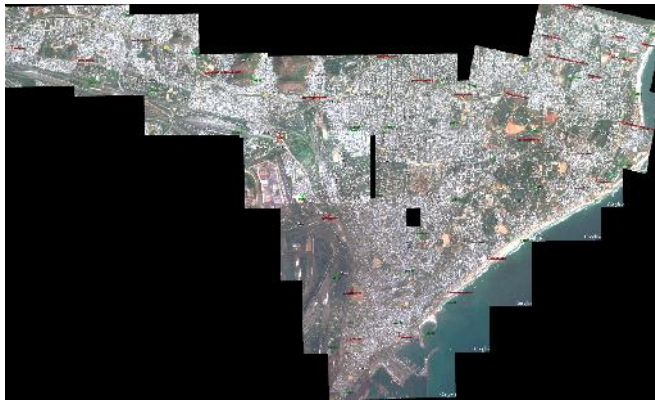
Study Area

Fig.2. Mosaic image of the entire study area

The area selected for the analysis of the road network in Visakhapatnam is the entire road network occurring in the between the areas of the Venkogipalem-NAD-Beach road (Fig.2). This area almost covers the important junctions in the city and also covers most of the road network in the city. It is one of the most densely used road either for transportation of goods or transport by the to and fro travelers used daily for errands, college or any office purpose. It consist the basic network connecting to the heart of the city. So the road network connecting this area has loads of traffic during the peak as well as the non peak hours as most of the people from surrounding areas would travel along these roads. The entire road network consists of all the important dwelling area and also the business centers for the city. The analysis of this part of the road network will carry almost all the traffic entering and leaving the city.

Road Networks

The total road network within the port limits is about 85kms. About 23.5kms of road network is available within the operational area connecting the entire stacking areas for free movement of vehicles. Port connectivity road length 12.47kms was completed and implemented jointly by the port and NHAI through SPV-Visakhapatnam Port Road Limited. The flyovers cum road project facilities are in smooth movement of cargo traffic between the port and national Highway-5 in the city.
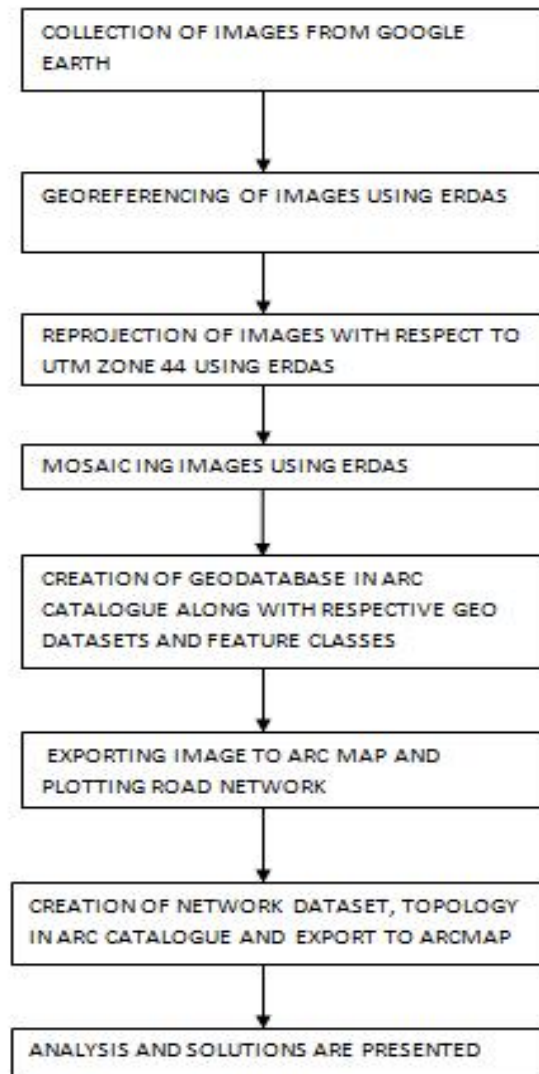
Methodology

Fig.3. Flowchart of Methodology

The methodology in Fig.3 has been used in the study. Raster-based image files need to be "Georeferenced" before they may be used in most GIS applications. This process assigns real-world
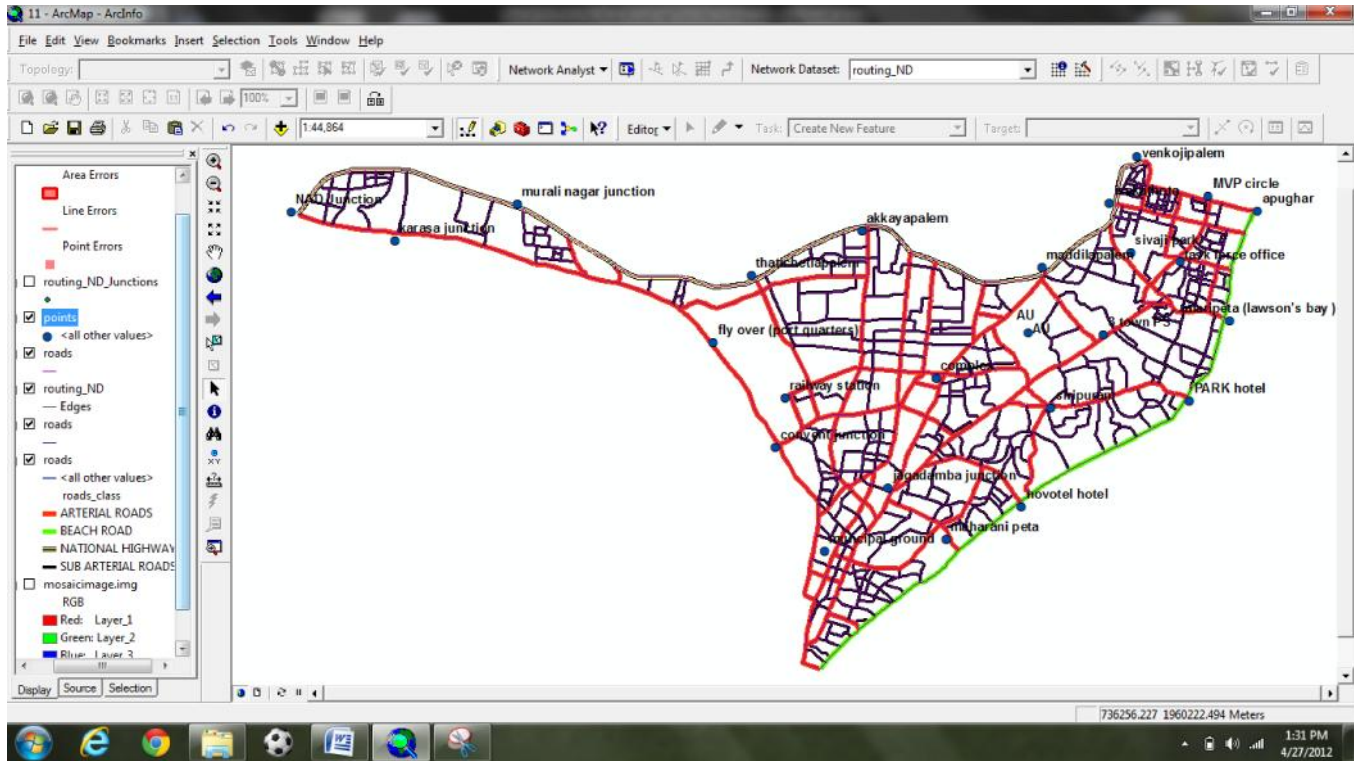
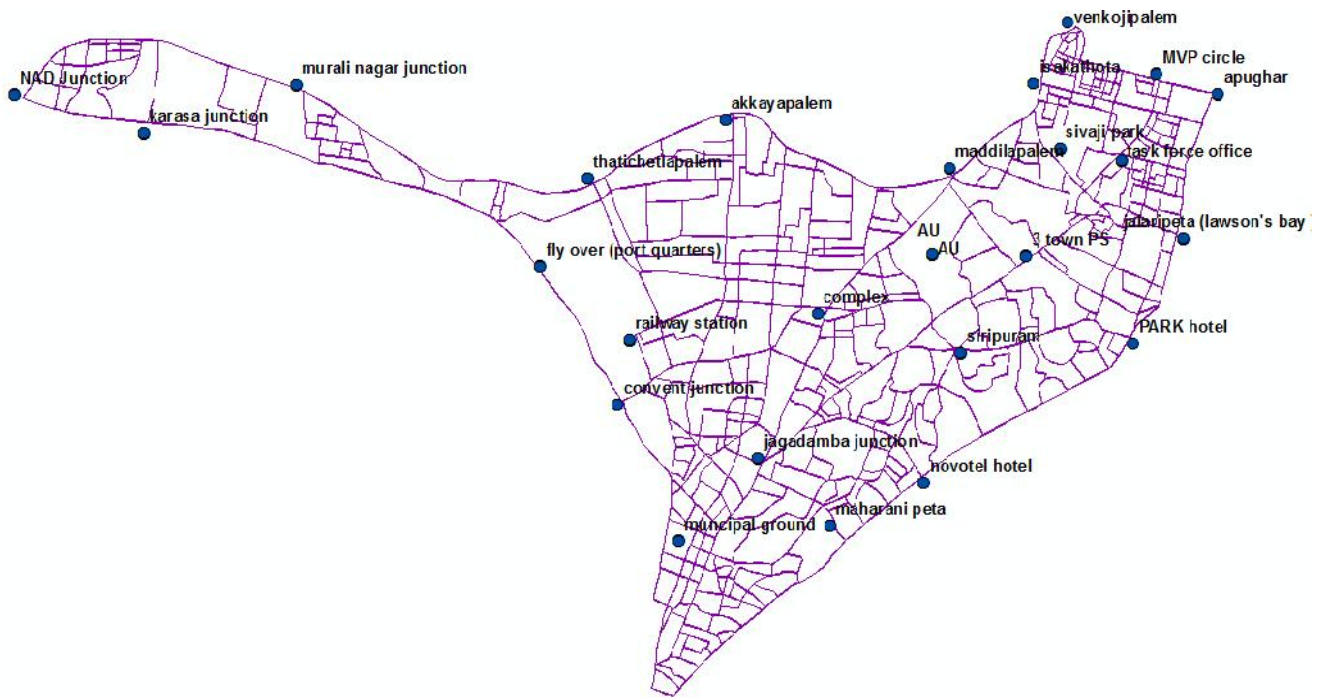*Fig.4*. Road Network along with classification of roads

Fig.5. Road network along with the names of the various
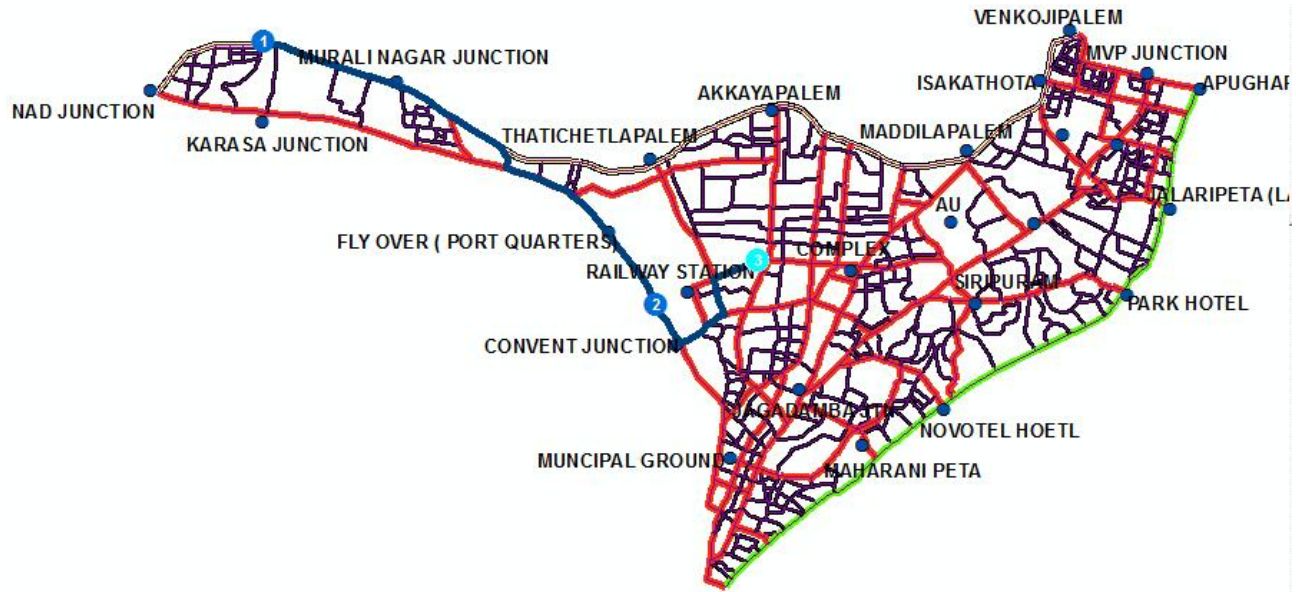junctions

Fig.6. Route depicted between the selected points

coordinates to all of the pixels contained in the image file. Implies to stitching-up all the smaller images are re-projected and adding them up as one of single image which is used in the Arc GIS for the rest of the analysis work. The images are attached to each other and thus helping us to have a clear and proper view of the entire work place.

Creation of personal geo-database in the ARC CATAGLOGUE and it is named as "road network". In the geo-database, it is further divided into datasets and feature classes. The dataset created is named as "routing". There is no compulsion that it has to be named this way or that way. The coining of the name can be done according to personal wish. The dataset created is further subdivided into feature classes which consist of two classes as points and roads (Fig.4). Add the data created and the study area image to ARC MAP. Start editing and draw the road network and locate important points and junctions in ARC MAP. The roads while plotting is also classified (Fig.5).

Results and discussion

Analysis of the road network drawn earlier is plotted. Analysis can be done like for example provision of a new route, new service area or even a new closest facility. They are done by selecting

any two points or by providing any number of points in the road network drawn and selecting the any of the above analysis options. By selecting the options discussed in methodology the required route between points is given accordingly. The route which is depicted when there has been ONE barrier that is placed in the path joining 1, 2 and 3 (Fig.6). The route now shows an alternating path that does not involve the barrier that has been placed along the path that is between 1 and 2 and thus it also helps in showing alternating paths when various barriers have been placed.

Conclusions

The Google earth provides the route that can be followed between any two points selected, but the route would be shown by using the major roads only. But the route displayed would not consider the short paths or any obstacles it is a major disadvantage when the route has lots of obstacles like accidents, road damage due to floods, road repair etc. With the help of ArcGIS it would overcome these problems by showing the shortest path weighing all the pros and cons of all the routes available between the points selected. Hence the route that is provided would be the best considering all the alternatives. The work done would be helpful in further developing new service area,

closest facility, fastest path, etc. A combination of traffic engineering specialists and computer applications specialists in the related field would help to see that the application can be easily handled by all kinds of users.

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