



Research Article

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**Urban utility information systems using Geospatialdata:
A case study of Tumkur urban area in Karnataka state**

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ABSTRACT

Cities are experiencing an increased use of utilities in their day-to-day life. The growth and development of the urban area largely depend on provision of urban utility services, As a matter of fact there is a wide gap between the availability and need of the utilities. Good quality of road Network, Water Supply, Proper Urban Land use and Major Urban services and School, Bank, Hospitals, Fire and Police station, Market and Entertainment are Major Utilities which indicate of the quality of city. GIS is one of the most efficient ways to get the view of any object or phenomena on the Earth's surface. Remote sensing techniques is an efficient tool for identifying the Urban growth from spatial and temporal data. Here an attempt has been made to understand the urban infrastructure using RS and GIS. The present research paper focuses on the mode of eliciting the urban utilities in a cartographic manner and indicating its proximity with respect to Road Network and find the optimal path of Tumkur Urban. Geo- eye Data and SOI toposheet are used for reference. GPS Survey carried out for collecting the various utility services within the Tumkur urban area. LISS IV Satellite image used to prepare LU/ LC map, Network analysis used to find out optimal path for rapidly accessible utilities. From the study, it is concluded that there is an ample scope for providing the utilities in the periphery of Tumkur. Besides prevailing clustered service center only in the city.

Keywords: GIS, GPS, Remote Sensing, Urban Utility.

INTRODUCTION

Urbanization is the processes through which the forests, fertile, agricultural land surface, Water bodies are being irretrievably lost. In India the percentage of people living in cities and urban areas almost doubled to 32% in year 2011, was low when compared to developed countries. The basic utilities of civil life for their well being and happy social life. Services includes Roads, Drains, Water Supply and sanitation, street light, Health services and maintenance of public places. In addition, they performed certain regulatory functions relating construction of Buildings, public area and commercial places for public well being like Banks, ATM, Fire station, Ambulance, Schools, Colleges, Hospital and Blood Banks. Police station and entertainment locations establishments in proper place in the area, in the urban area due to uncontrolled urbanization has been responsible for many of problems like Vertical and Horizontal urban growth, High land cost and problems of drinking water, noise and air pollution, disposal of waste, Traffic congestion. The significance of the present study is to represent various kinds of utility services like Blood Bank, Hospitals, Ambulance, School and Colleges in Tumkur area.

AIMS & OBJECTIVES

The aim of the research is to map the available various services in the Tumkur area by using RS and GIS with the following objectives.

1. To prepare detailed Road Network Map.
2. To identify the Urban, Sub Urban, Rural area from LU/LC Classification.

3. To prepare the shortest route for required services.
4. To identify utility services with different categories.
5. To develop Query Analysis.

STUDY AREA

Tumkur is an industrial city located in state of Karnataka. It is situated at a distance of 70 kilometers northwest of Bengaluru. Tumkur is the headquarters of Tumkur district. Tumkur Urban area lies between 13.34°N Latitude and 77.1°E Longitude. The Tumkur district is known for the production of coconut, is called as 'Kalpataru Nadu'. The mineral wealth of tumakuru is considerable; iron is obtained in large quantities. The annual rainfall averages 39 inches. Tumkuru is good study center from primary education to higher education. It has its own university. Within this town, there are seven technology institutions, one medical institution and one dental institution. It has an average elevation of area is 822 meters.

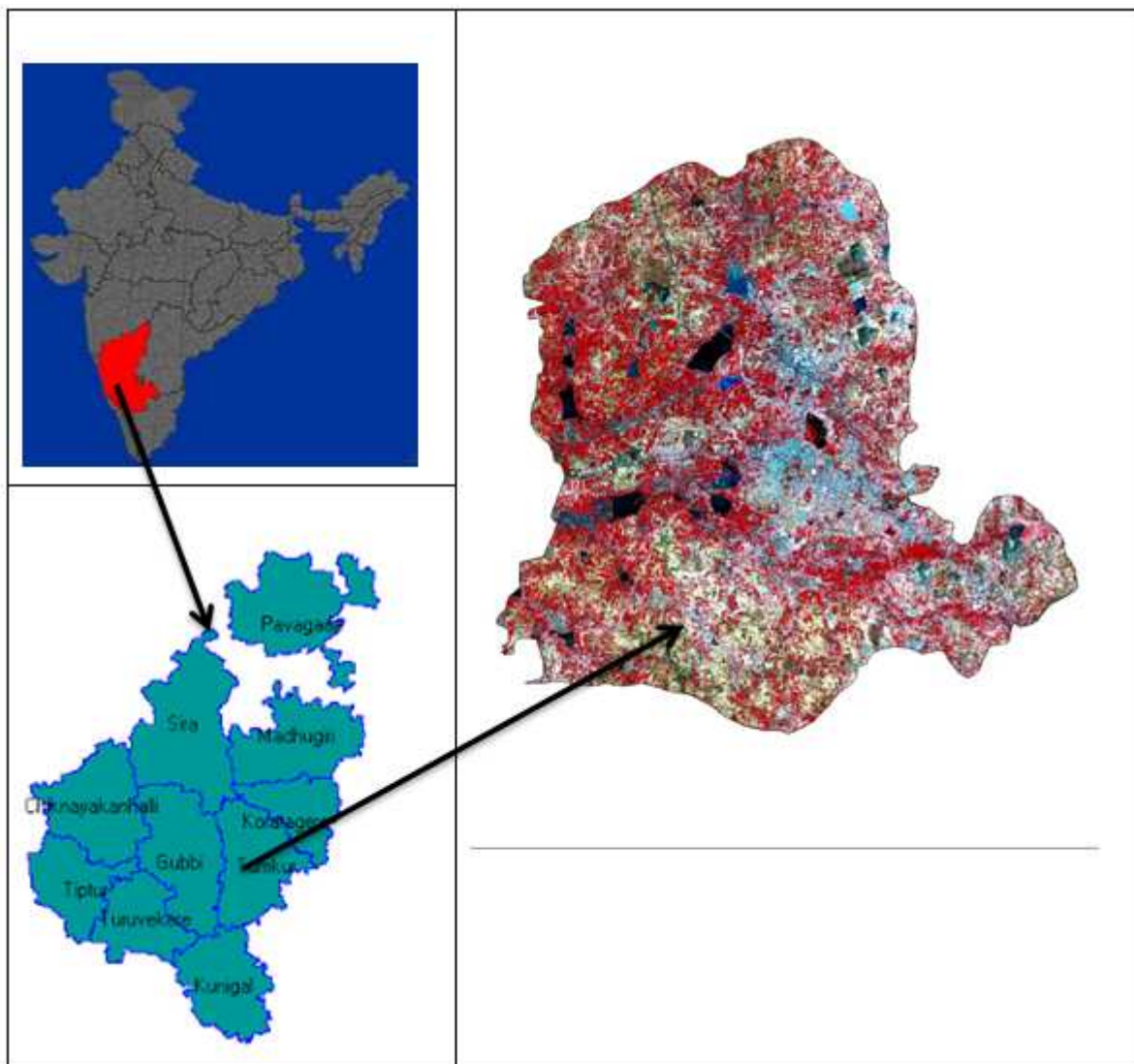


Figure-1 Location Map of study area

EXPERIMENTAL SECTION

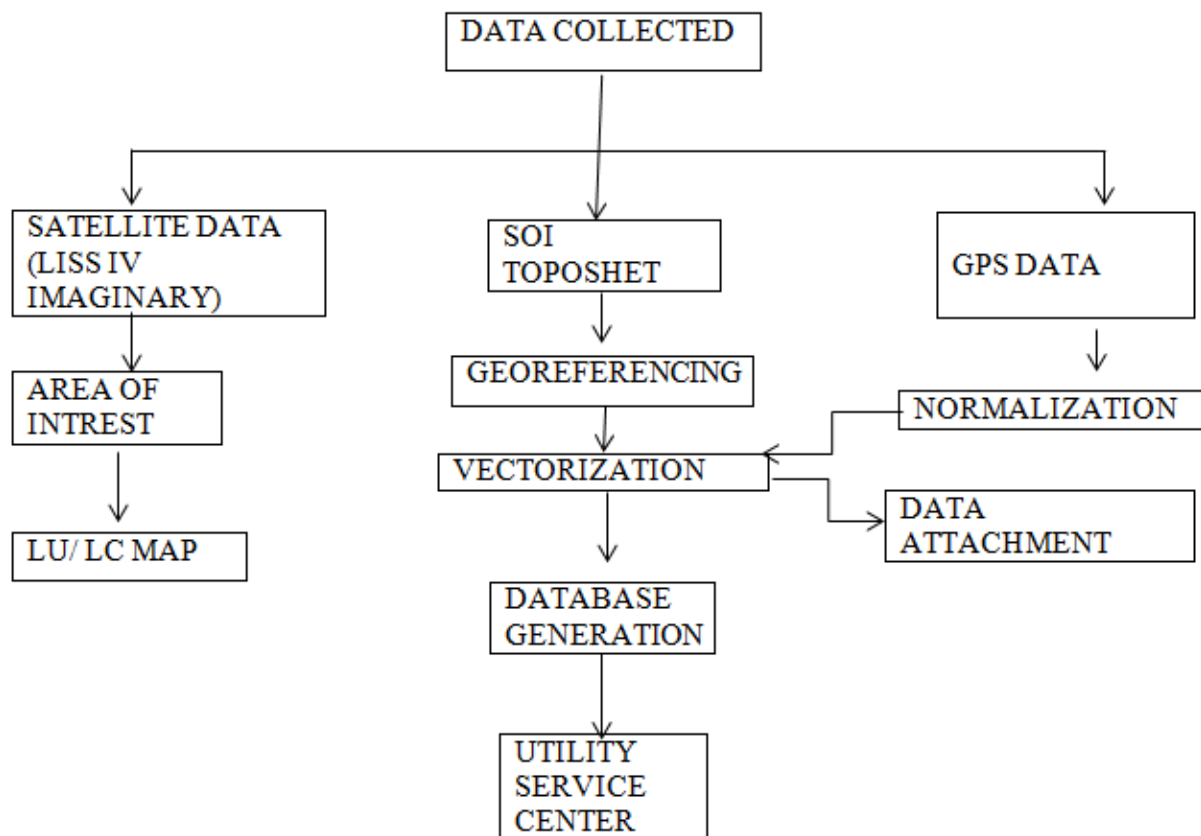
The data was collected from various sources. The SOI toposheets were subjected to georeferencing in Arc GIS10.0 software. Geometric corrected in ERDARS Imagine 9.1 with 25 Ground control point. The resampled image was given projection with WGS 1984, 43 North Zone. The IRS P6 LISS IV satellite imagery of same area was georeferenced using the reprojected toposheets with 25 Ground control points RMS error was kept below 1. The attribute data for utility features are arranged in Excel data base. GPS and Google Earth were used for collecting geographical location points of various utility features. Excel file created for different service area with Latitude and

Longitude and different fields were displayed as point layers. The Road Network was generated from toposheet of Tumkur urban area.

Table 1: Data details of the Area

PRIMARY DATA	SECONDARY DATA
i. LISS 4 (PATH ROW:99/64, YEAR:17 March, 2014) ii. TOPOSHEET (D43R2-57G/2, D43Q15-57C/15, D43Q14-57C/14, 57G/4, 57G/3)	i. GPS Points ii. Google Earth Data

FLOW CHART OF METHODOLOGY



RESULTS AND DISCUSSION

LAND USE / LAND COVER MAP:

Land use – Land cover Map shows in figure 2 the distribution of study area in various purpose like Built up, Forest, Barren Land, Crop Land, Water bodies etc. Remote sensing technology plays important role for land use mapping and the trend of their changes over time of period. The LU/LC Mapping was done using high resolution IRS P6 LISS IV imagery acquired on 17, March 2014.

GENERATION OF ROAD NETWORK MAP

Road Network Map of the Tumkur taluk is important for taking benefits from various utility services like school-colleges, Bank, ATM, Hospital etc. The figure 3 shows the Major and Minor road network of Tumkur taluk. It is useful for establishment of utility centers. The Tumkur taluk Road Network is very well connected and Mainly concentrated at center part of Tumkur.

UTILITY MAP OF EMERGENCY SERVICES

The Emergency Services are the most important utility service. The Figure 4 shows the distribution of Emergency Service like Hospital, Ambulance, Blood Bank, Fire Station, Police Station.. In this Blood Bank are concentrated near to Hospital and taluk center part. There is need of new Blood Bank and Ambulance Service centers in outer part

of urban area. General Hospitals are also concentrated at center part of urban area. In future outer urban area are need establishments of number of hospitals and to provide health facility to urban area.

PUBLIC UTILITY MAPPING

The public utility for people play major role for providing urban utility. The figure 5 shows the various public utility like post office, Railway station, Water Treatment plant, etc.,. It is useful to establish the urban utility services. Mostly all public utilities at center part of urban area.

UTILITY MAPPING OF EDUCATION CENTER

Urban area are always famous for good and advanced education facilities. Tumkur urban is one of the famous area for good quality of education and education center. The figure 6 shows the various Education center like school and colleges. Colleges include university, Medical colleges, Engineering and Arts and science colleges. Maximum schools and colleges are covered at center part of Tumkur urban area. Need some more education center at outer boundary of Tumkur urban.

UTILITY MAPPING IF ENTERTAINMENT AND TEMPLE

Entertainment and Temple are very essential utility for people in their day to day life. The figure 7 shows the various distribution of utility like Theater, Park, Temple, and Stadium. Very few entertainment area and huge temple are present at center part of urban area.

MAPPING OF TRADING SECTOR AND PRIVATE SECTOR:

This sector a key role of providing urban utility. This is most important utility for people. The figure 8 shows the various trading and private sector like Bank, ATM, Hotel. Petrol bunk, Private Limited Industries. This utilities need to improve in urban area.

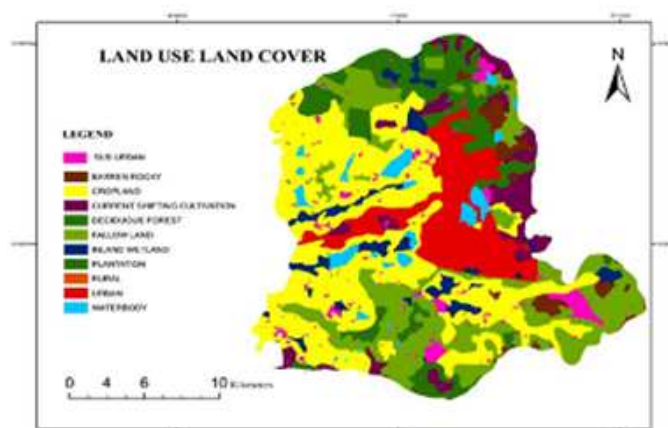


Fig2- Land use Land cover



Fig 3- Road Network

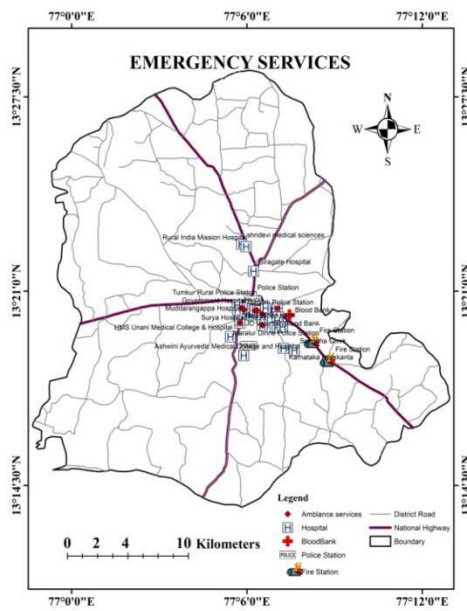


Fig 4- Emergency services

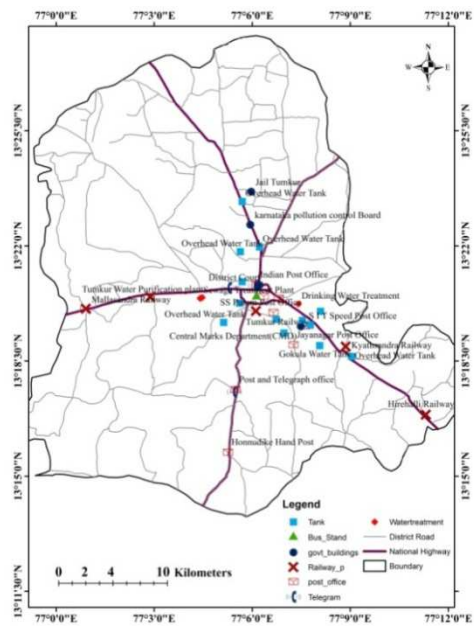


Fig 5- Public Utility

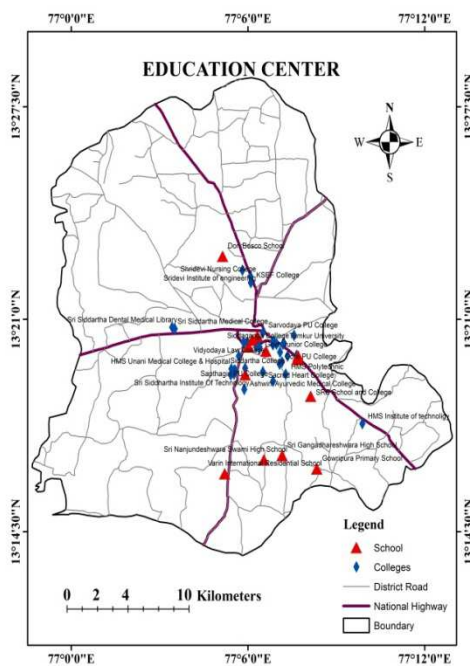


Fig 6- Education Center

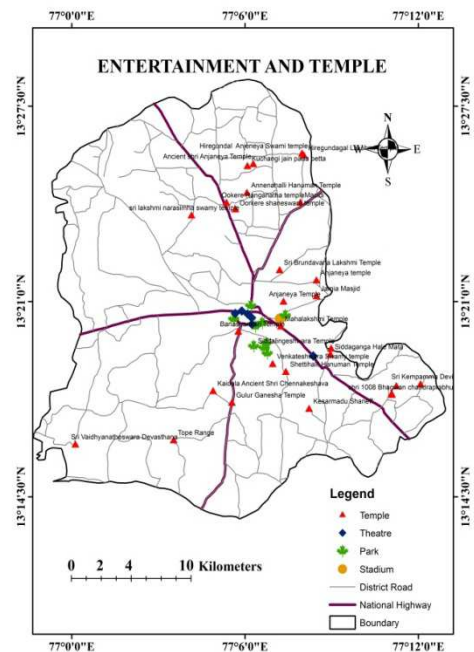


Fig 7- Entertainment and Temple

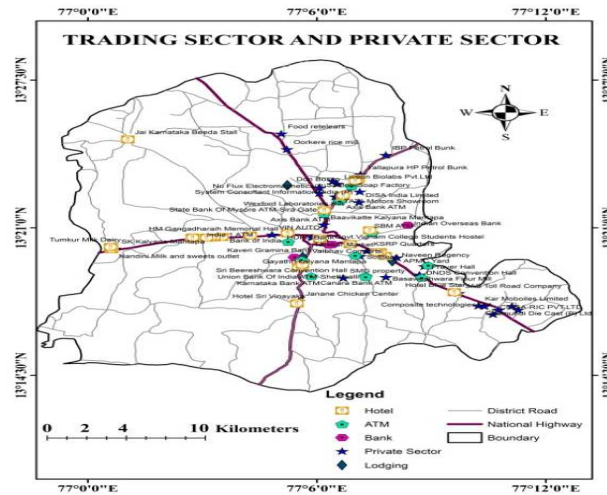


Fig 8- Trading Sector and Private Sector

OPTIMAL PATH FOR HOSPITAL SERVICE:

With the help of RS and GIS we can calculate accurate distance and time from incident to facility. Here calculate distance(meter) from incident KSRTC Bus stand to facility(Hospital). Here we can consider the average speed of vehicle have 30km/hr. Shown in Fig- 9

In this Surya Hospital is very nearest. The distance between two place 749.727 meter & Then Akshaya Hospital is far way from facility. The distance between the two place 3231.848 meter. Shown in Figure 16.

OPTIMAL PATH FOR BLOOD BANK

In this Belli blood bank very nearest. The distance between two place 711.781 meter& Then JC Blood bank is far way from facility. The distance between the two place 3258.917 meter. Shown in Figure 10.

OPTIMAL PATH FOR FIRE STATION

In this District Fire office is Near. The distance between two place 5027.208 meter & Then Fire station is far way from facility. The distance between the two place 7188.814 meter. The distance between two Fire station is 2225.855meter Shown in Figure 11.

OPTIMAL PATH FOR GOVT BUILDING

In this Court very nearest. The distance between two place 1016.254 meter & Then Tumkur Jail is far way from facility. The distance between the two place 3258.917 meter. Shown in Figure 12.

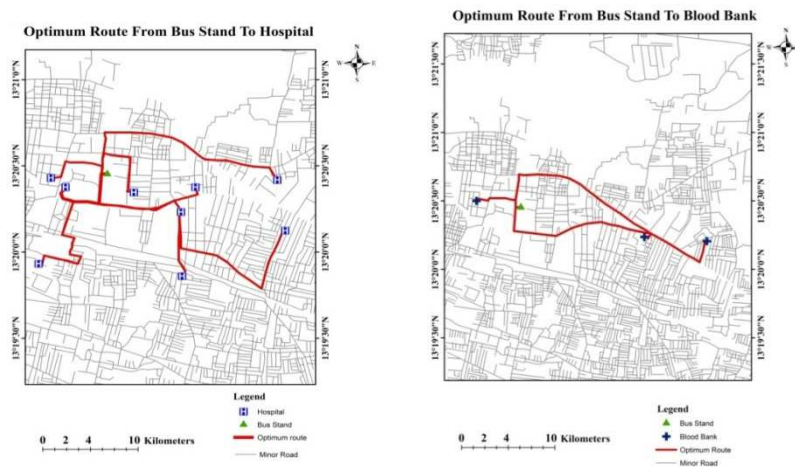


Fig-9 Optimum Route for Hospital service Fig-10 Optimum Route for Blood Bank

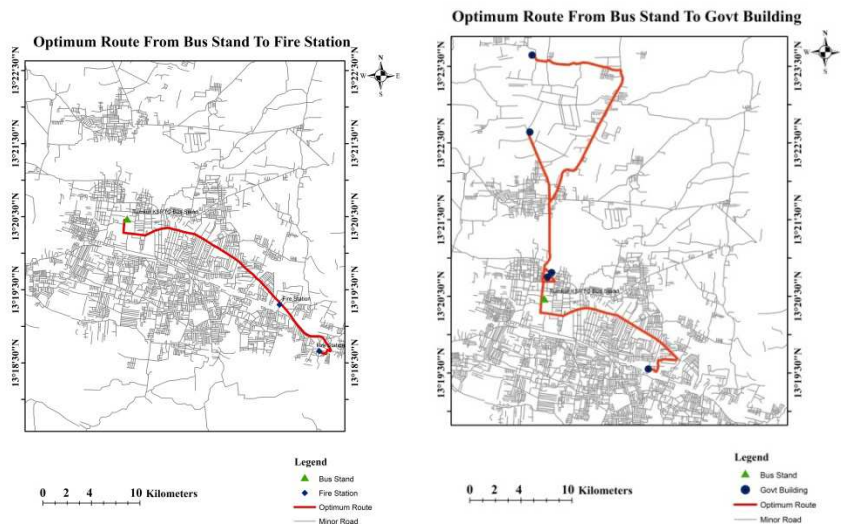


Fig-11 Optimum Route for Hospital service

Fig-12 Optimum Route for Blood Bank

Table 2 Data base design

Urban Utility	No. of Services
School	14
Colleges	37
Fire station	2
Stadium	1
Park	9
Govt building	5
Temple	26
Post office	8
Police station	4
Railway station	5
Ambulance service	8
Hospital	36
Private sector	33
Tank	13
Bank	4
ATM	15
Hotel	27
Water treatment plant	3
Telegram	3
Theatre	6
Lodging	4

Table 3 Optimum path of Hospital service

Hospital	Distance_meter
Shri devi hospital	958.955
Surya hospital	749.727
Govt. Hospital	873.412
Vijaya Hospital	1979.075
Manipal Hospital	2325.324
Bharathi Hospital	1454.260
Aruna Hospital	1277.329
Vinayaka Hospital	1991.953
Akshaya Hospital	3231.848

Table 4 Optimum path of Fire station

Fire station	Distance_meter
District Fire office	5027.208
Fire station	7188.814

Table 5 Optimum path of Blood Bank

Blood Bank	Distance_meter
Belli blood bank	711.781
JC Voluntary Blood Bank	2351.762
Blood Bank	3258.917

Table 6 Optimum path of Govt. Building

Govt. Building	Distance_meter
CMD	4990.510
Tumkur Court	1016.254
District collector office	1047.930
Pollution control	4257.743
Tumkur Jail	8496.797

CONCLUSION

In the present day, cities are increasing in vary rapid rate and needed to develop various urban utilities to fulfill the urban need. In this urban planning, urban sprawl monitoring , urban development monitoring are necessary to make effective policy for unplanned areas. This present study brings out a definite relationship between the remote sensing and GIS techniques. Which play a significant role in urban utility information. Satellite data have become valuable tools in studying the spatial extent of land pattern identification. Land use is defined as to the human activity or economy related function associated with specific land. In this present study, urban utility facility like colleges, ambulance, hospital, are mainly concentrated at city center or core part of city. From study, it is concluded that there is ample scope for providing the utilities in the periphery of Tumkur. Besides prevailing clustered service center only in the city.

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