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# Flood Hazard Assessment and Identification of Danger Zones Using GIS

Vaibhavi A. Chinaiwala[1], Tejash S. Dalia[2], Dhwanil P. Dave[3], Janish R. Gaekwad[4], Yash D. Jariwala[5], Nisha Soni[6]

[1,2,3,4,5]*B.E Student, Department of Civil Engineering, Bhagwan Mahavir College of Engineering & Technology, Surat.*
[6]*Professor, Department of Civil Engineering, Bhagwan Mahavir College of Engineering & Technology, Surat*

***Abstract- Climate change is one of the biggest concerns for the world in present time. Climate change can lead to frequent floods in some region. Flood is one of the devastating natural disaster which leads to loss of lives, properties and resources. It causes damage to infrastructure of city which includes buildings, bridges, roads, streets, water supply system and electric grid system. Excess amount of resources is spent to restore the people of affected area and for repair and rehabilitation of infrastructure. The amount to be spent can be reduced if flood hazard maps are available. Flood hazard maps can be prove beneficial to urban planner for future development of city and to disaster management authorities to carry out evacuation of people from flood affected areas in such conditions. The intent of this study is to generate flood hazard maps for a particular city or region by GIS tools and satellite images. This study will demonstrate the potential of GIS in civil engineering and in flood mitigation.***

***Keywords – flood, hazard maps, GIS, DEM, river***

## INTRODUCTION

Floods are the most damaging and accepted accustomed disasters that affect societies of the world. One abstraction estimated that more than than one-third of the world's land surface area is vulnerable to flood affecting some 82 percent of the world's population. Due to all-around warming, the anticipation of potentially damaging floods occurring is acceptable to increase as an aftereffect of it in the form of increase in intensity of precipitation events. Normal floods are accepted in many regions of the world as they accommodate affluent soil, water and a mode of transport, but calamity at an abrupt calibration and with boundless abundance causes accident to life, livelihoods and the environment.

Table-1 World scenario of damage caused by disasters

| Type of natural disaster around the world | Damage caused by natural calamities (%) |
|---|---|
| Floods | 32 |
| Tropical cyclones | 30 |
| Droughts | 22 |
| Earthquakes | 10 |
| Other disasters | 6 |

It emphasized the charge to accept the interaction between amid hazard and people's vulnerability. Vulnerability to flood hazards is likely to increase unless able flood acknowledgment and administration activities are implemented. The capital aim of this study is to accommodate flood simulation model and remote sensed data with topographic and socio-economic abstracts in a GIS ambiance for flood accident mapping of surat city. Flood is a serious, common, and much costly hazard that abounding countries face regularly. Identification and mapping of flood prone areas are admired for accident reduction. Flood accident mapping consists of digital modeling of area with the topographicaland land use characteristics of the abstraction area.

## I. SCOPE OF WORK

The scope of this work are as follows:

1. Residents can have different sets of information about flood hazard from prepared maps.
2. Flood hazard maps helps emergency teams to conduct assistance operation and rescue and evacuation during time of flood as best as possible.
3. Maps helps urban planners in confronting flood before its occurrence due to vulnerability of each region and possible scenarios of flood crisis with prediction programs.

## II. METHODOLOGY

### A. Study area


FIG. 1 SURAT ADMINISTRATIV BOUNDARY SOURCE- Google image

Surat city is also known as Suryapur which is situated on the bank of the Tapti River. The city has been ranked 95th in the list of world's largest cities and is the 9th largest city of India after Pune with an area of 326.515 Sq.km. Floods are an increasing problems for Surat city, situated at latitude 21° 06’ to 21°15’ N and longitude 72°45’ to 72°54’ E on the bank of river Tapi having coast line of the Arabian Sea is on its West.

### B. Problem statement

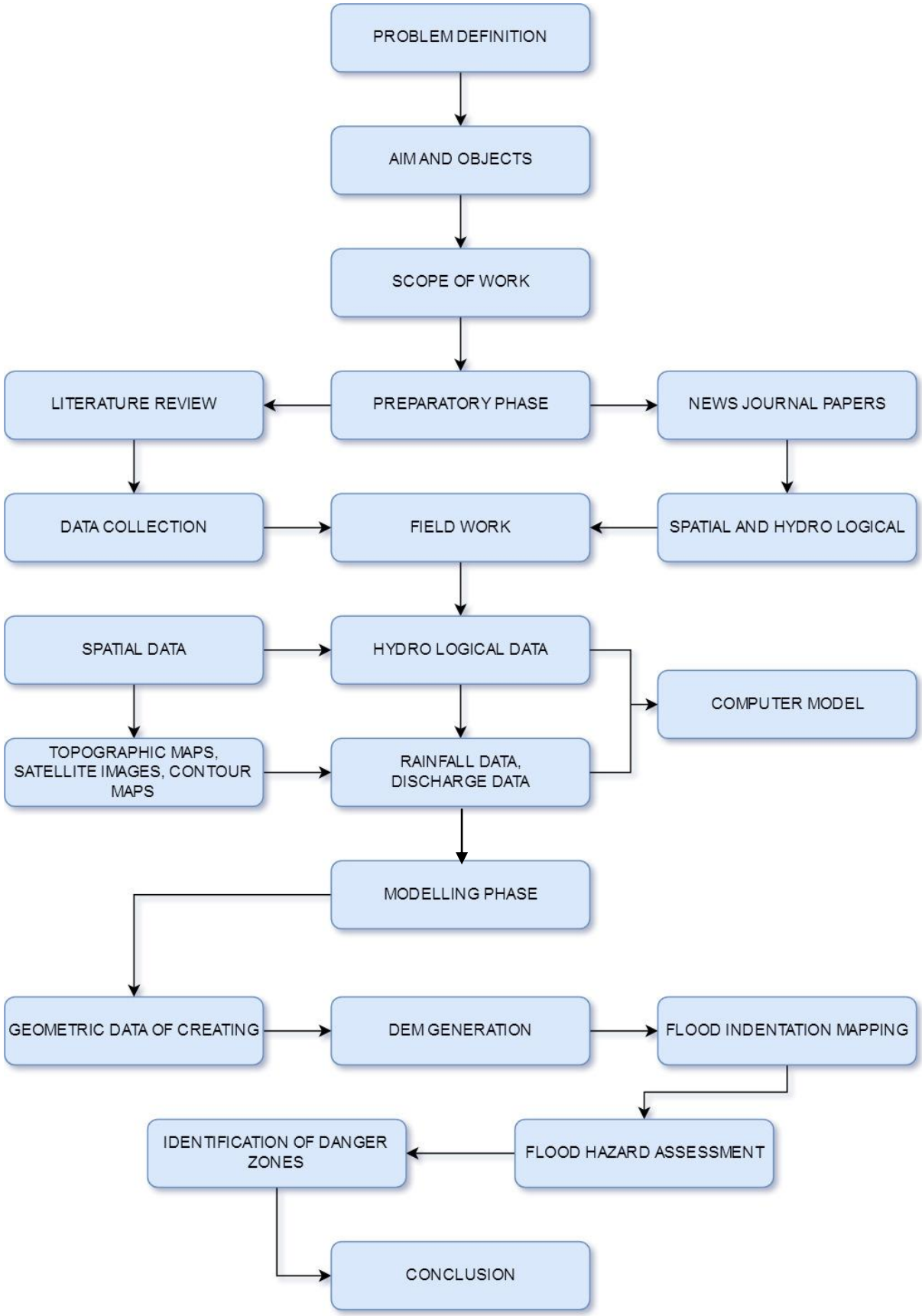
Surat city is one of the most vulnerable city in india for flood in last decades. Flood is considered as a disaster and claiming millions of death around the world. This is true for this study area also, more than five times flood occurred over this area already claimed more than thousands of life.

| Flood event | Discharge (lac cusecs) | Water level at hope bridge (m) | Period |
|---|---|---|---|
| 1944 | 11.84 | 11.32 | August |
| 1968 | 15.5 | 12.08 | August |
| 1994 | 5.25 | 10.10 | Aug-Sept. |
| 1998 | 7 | 11.40 | September |
| 2002 | 3.25 | 8.2 | September |
| 2006 | 9.09 | 12.40 | August |

Flood events of surat city

| Subject | Details |
|---|---|
| Area | 326.515 sq. km. |
| Population | 44,66,826 |
| Density | 13680 |
| No. of slum pockets | 334 |
| Zones | 7 |
| No. of election wards | 29 |
| No. of employees | 18,369 |
| Sex ratio | 756/1000 male |
| Crude birth rate | 14.67% |
| Crude death rate | 4.14% |
| Maternal mortality rate | 0.46% |
| Literacy rate | 87.89% |
| Male | 91.22% |
| Female | 83.44% |
| Decadal growth rate | 55.29% |

**C. Proposed methodology**



GIS database creation primarily involves process like data collection, mapping, digitization, and GIS error handling, attaching attributes data and making GIS data usable. The major tasks involved in database creation are:

1. Collection of satellite data, tables and maps.
2. Analysis of satellite data for developing thematic maps using GPS field observations for generating ground control point's library, and Creation of spatial framework
3. Geo-referencing process of satellite image data and scanned map data. Environment setting.
4. Analysis based on GIS maps.

The methodology adopted for developing the information system of the study area is based on the analysis of the integrated database of both spatial and non-spatial data under GIS environment.

The spatial data contains different maps of land use/land cover, base details, slope, geology, Geomorphology, drainage, watershed, and soil maps. The non-spatial or demographic data is composed of socio-economic data collected from different government departments.

### A. Generation of Thematic maps

The different thematic maps namely, land use/land cover, Geomorphology, geology, groundwater prospectus map and soil are generated from IIRS geo portal name BHUVAN satellite. The standard basic and key elements for visual interpretation of maps are to be applied on this satellite hardcopy of digital image so as to access the information extent in compliance with the above thematic maps. At the end of the interpretation process the above thematic maps in the form of paper based maps are ready for subsequent scanning and automated digitization in GIS environment and then creating a digital database for GIS data analysis process.

### B. Integration in GIS environment

In GIS, topology is the geometric characteristic of objects, which remains constant under transformations and are not dependent of any co-ordinate system. Topology consists of metric aspects of spatial relations, such as size, shape, distance and direction. The geometric relationship between spatial entities and corresponding attributes are very important for spatial analysis and integration in GIS. Digital elevation model is to be prepared from the base map of the study area and simulation of the model is to be done and different analysis is carried out as per the requirement. The analyzed data can be prepared in form of data tables and flood maps which can be used for different purposes.

## III. RESULT AND DISCUSSIONS

River Tapi passes from the central part of the Surat city. The area on both the sides of the bank are much highly populated area. The discharge carrying capacity of the Tapi River has reduced over the last years which makes the adjacent areas more vulnerable to flood. Due to low discharge carrying capacity, in times of monsoon season when there is heavy discharge of water released from the dam than the areas along the banks of rivers and which are having low elevations are at major risks.

This GIS-based model will help the users in analyzing flood related information, to retrieve data/information, make useful queries and research on spatial and nonspatial database to identify candidate zones which are vulnerable and which are safe from flood; and generate various views or scenarios for taking better decisions.

## IV. CONCLUSION

The use of GIS and remote sensing is proved to be useful for emergency and evacuation operations as well as for hazard assessment to infrastructure of city. Flood hazard maps can be used used as a decision support tool by authorities during time of flood crisis. To mitigate the flood hazard, a better and effective flood management techniques, preparedness planning and impact assessment after flood is required which can be done by use of GIS. Readily available hazard maps can be used to identify the zones of shelter and providing medical supplies during flood. It helps government authorities to identify the flood risk before its occurrence and hazard maps can serve as a beneficial tool for future town planning.

## V. ACKNOWLEDGEMENT

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