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Flood mapping in Ernakulam using QGIS.

Mapeo de inundaciones en Ernakulam usando QGIS.

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ABSTRACT

Urban flooding is a challenge faced by many expanding cities and towns of developing countries. Remote sensing and GIS are effective tools that help for flood risk management. Ernakulam city has been facing flood during heavy rainfall. In this project, the various flood causing factors have been identified and it aims to depict the flood prone areas and create flood risk map for Ernakulam city using (QGIS) Quantum Geotechnical Information System. Boundary, elevation, canal network, land use land cover and flood maps are generated using QGIS software. Geospatial data can be viewed, edited, printed, and analysed using the free and open-source desktop geographic information system (GIS) application QGIS.

Keywords: Urbanization, Flood mapping, Urban flooding, Stormwater management, QGIS software.

RESUMEN

Las inundaciones urbanas son un desafío al que se enfrentan muchas ciudades y pueblos en expansión de los países en desarrollo. La teledetección y los SIG son herramientas eficaces que ayudan a la gestión del riesgo de inundaciones. La ciudad de Ernakulam se ha enfrentado a inundaciones durante las fuertes lluvias. En este proyecto, se han identificado los diversos factores que causan inundaciones y su objetivo es representar las áreas propensas a inundaciones y crear un mapa de riesgo de inundaciones para la ciudad de Ernakulam utilizando el Sistema de Información Geotécnica Cuántica (QGIS). Los mapas de límites, elevación, red de canales, uso de la tierra, cobertura del suelo y inundaciones se generan utilizando el software QGIS. Los datos geoespaciales se pueden ver, editar, imprimir y analizar utilizando la aplicación de escritorio del sistema de información geográfica (SIG) QGIS, gratuita y de código abierto.

Palabras clave: Urbanización, Mapeo de inundaciones, Inundaciones urbanas, Gestión de aguas pluviales, Software QGIS.

INTRODUCTION

Ernakulam is one of the fastest developing cities in Kerala. The city has been frequently affected by flooding events. Ernakulam once had a well defined canal system [11]. Owing to its proximity to sea, the canals were subjected to regular tidal inflow and outflow which kept the water in the canals naturally clean [11]. However, the urbanization and need for road development paved way to diminishing canals and water bodies.

Improper stormwater management in the city has led to waterlogging, flood formation, and pollution of water bodies [12]. Insufficient control of urban floods has even been causing many social problems. The project aims to create flood risk map using QGIS software. Flood risk maps serve as the foundation for flood prevention [9]. These maps are frequently created based on the results of hydrological models, which call for the use of digital elevation models (DEMs) to represent the topographical surface and specify flood pathways in QGIS software (Quantum Geotechnical Information System) [1]. Digital Terrain Models (DTMs) and Digital Surface Models (DSMs) are two different types of DEMs [1]. In urban settings where a DSM is preferred for flood studies [1]. The primary benefit of using QGIS for flood control and planning is that it produces a visual representation of flood prone locations [5]. In order to help and advance flood monitoring and mapping, remote sensing data primarily concentrate on gathering studies and experiences [11]. The flood mapping helps to determine the flood prone areas which is beneficial for the authorities to take mitigation measures accordingly. The objective of the project is to analyse factors causing flood in Ernakulam and to prepare corresponding maps to increase awareness of flood risk and improve flood risk management.

Fathima Shajahan (2021) in this paper they employed QGIS and ArcGIS software to map the Ranni area in the Pathanamthitta district with respect to physical, demographic, and socioeconomic vulnerability indicators, analyse the elements that contribute to flood risk, and provide structures that will help to reduce flood risk using a ranking approach [3].

Lindsay Brenmer (2019) in his paper examines the 2015 floods in Chennai, Tamil Nadu, India, as the result of policies, plans, and procedures that had erased monsoon water and wetness from the city and its imaginary for many years. The conclusion of the paper speculates on whether planning itself may be envisioned as a more inclusive, cosmopolitical enterprise after making some critical remarks about these trials [1].

Muhammad Ameen(2019) in this paper they employed GIS technology to map the 2018 floods in Kalady village in Kerala's Ernakulam district in order to assess their effects. Construction zones and agricultural lands are clearly more impacted, according to the flood chart. A flood vulnerability map for the Ernakulam district has been created by Rose Mary Xaviour, Anto Paul, Benila Raj, Kevin Joseph, and Varsha Antony (2020) by examining the flood maps from 2018 and 2019. This projected map can be used to make the necessary preparations and to take safety measures in regions that are prone to severe flooding [11].

Jean Joy(2019)in this paper they represent the lack of data renders remote sensing technologies and flood modelling methodologies obsolete, and this work proposes a novel way for flood mapping. For planning and future use, it is crucial to map the flood. In order to calculate the flood-inundated area utilising GIS and QGIS technology, they chose Meloor Panchayat in Kerala as their research location. This study shows how the flood-inundated area can be correctly mapped using GIS technology by utilising a participative technique to survey flood depth [9].

METHODOLOGY

Ernakulam is one of the 14 districts in the Indian state of Kerala. The study area is from the northern end of Vaduthala, the southern end of Thevara, Marine drive on west coast and pathadipalam on the east border. Total area is approximately around 50 km^2. Two important canals in the area selected for this study are: Perandoor canal and Chilavanoor canal. These canals connect the Periyar river through Muttar river on northern end and Thevara canal on the southern end. Fig 1 shows the study area map created using QGIS software.

FACTORS CAUSING FLOOD

Factors causing flood in this city have been identified [2]; Urbanization, Topography, Blockage of drainage system, Unscientific construction done across canal, Not providing proper width and slope to canal.

QUANTUM GEOTECHNICAL INFORMATION SYSTEM

QGIS is an open and free source of software. It is a GIS type of database consisting of some software tools that enables users to create, modify, analyse, manage and manipulate geographical data. It supports both raster and vector layers.

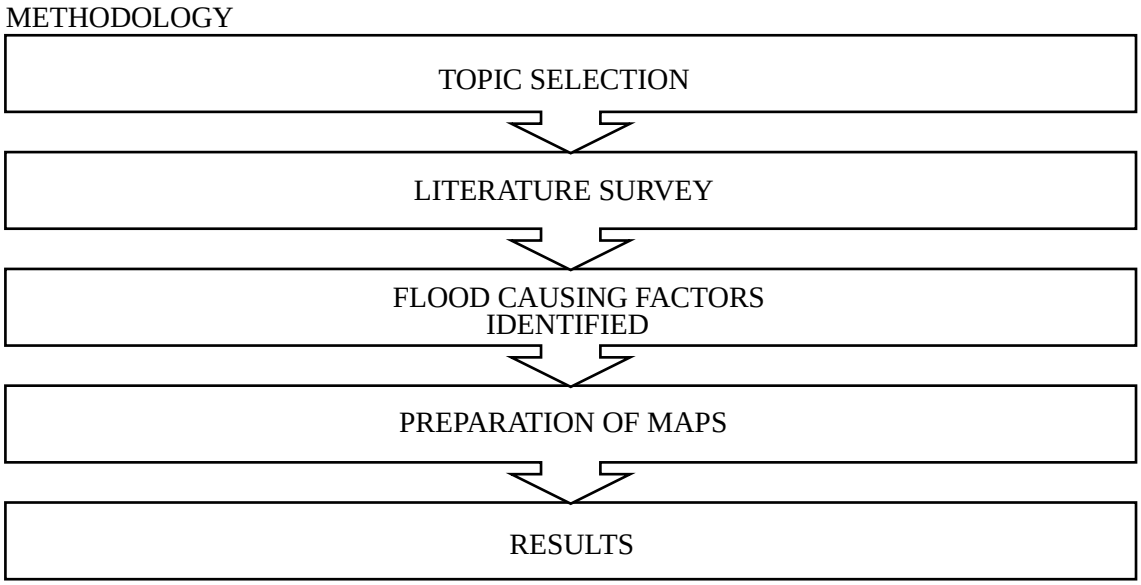

Fig1 Methodology

1. Boundary map of study area: The shape file of study area map is prepared using QGIS software. The study area is obtained using base map. The base map is downloaded using the plugin Q map. Then the OSM is obtained using web. The selected canals and site boundaries are located and added to the map using new temporary scratch layer. Thus, the fig 1 shows the boundary map of study area.

2. Elevation map:From Bhuvan, elevation data or a DEM is retrieved. Digital Elevation Model (DEM) is a three-dimensional representation of elevation data to describe geographical terrains. They are the most typical foundation for digitally produced maps and are frequently utilised in geographic information systems. Additionally,

this DEM data is processed in the software using a vector and raster tool to create a shape file of the DEM map. Thus, the fig 2 shows the elevation map of study area.

3. Land use land cover map: Land use and land cover mapping is carried out to study the land utilization and future planning and management of land resource. Five land use classes have been identified in the study region such as agricultural crop land, built-up (urban and rural), Water body, Forest area and wasteland. Thus, the fig 3 shows the Land use -land cover map of study area. The data shows most of the land is build area represented in red colouR

4. Flood map: Flood maps are produced using the Raster Calculator tool using the area same shape file as the DEM map. To create aflood map with a 1m rise in water, 1m of water is elevated above sea level. The map shows the consequences of flood in different areas of the city. To accomplish an informed risk reduction or to identify the best risk mitigation methods, the technique can be used to prioritise corrective actions. Thus, the fig 4shows the flood map of study area.

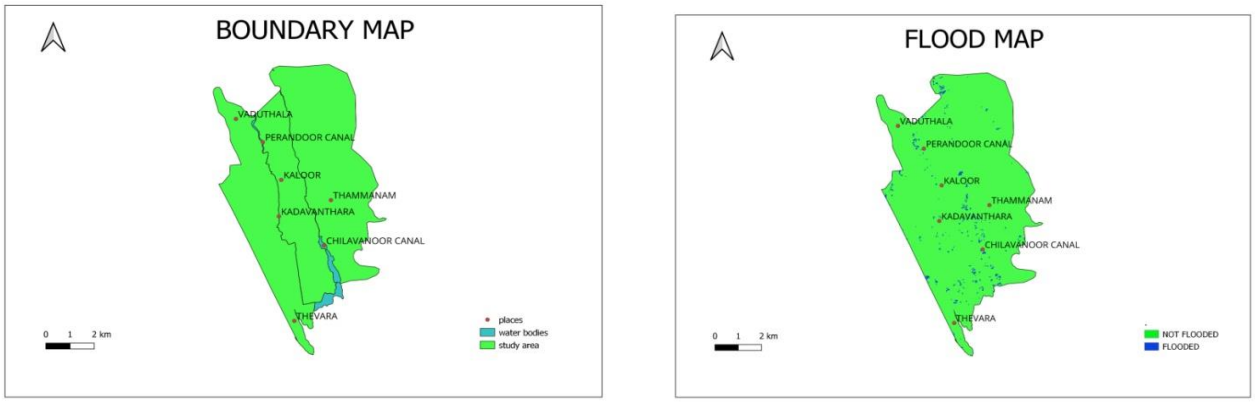

Fig 4 Boundary Map AND Flood map of study area

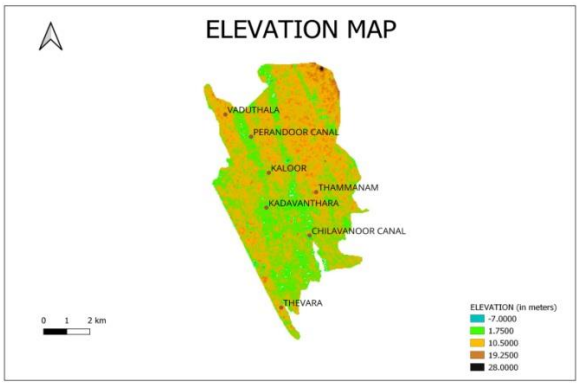

Fig 4 Elevationmap of study area

CONCLUSION

Ernakulam is one of the frequently growing cities in Kerala. Water logging and flooding are common problems throughout the city. Severalvariables generating these issues have beenidentified in the study.The primary causeswere deduced from this to be urbanization,topography, rainfall, and an inadequate drainage system. So, to find its preventive measures, the flood map and othercorresponding maps of the study area is generated using QGIS Software. From the flood map itself is clear that most of the study areas are severely affected by flood with a water level rise of 1m above the sea level. These maps help to give awareness for flood risk management and to take future precaution. The fundamental maps for the inundation models were made using digital elevation models (DEMs) from many websites, including SRTM,World DEM. After gathering and reviewing, thearea articles for this study, it can be said that flood mapping may be investigated using software by downloading DEM data, and flood frequency may be assessed using a variety of flood frequency analysis. This data will be extremely useful for future flood mapping research.

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