

Development of an Urban Utility Map of Adoor Municipality using GIS

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ABSTRACT

Utilities are fault-finding conveniences in a city for giving essential duties. The lack of accessible dossier concerning the locale of utilities can cause civil service disruptions, project delays etc. Geographical facts arrangement (GIS) is individual of ultimate adept habits to get the hypothetic view of some object. A utility map with the help of GIS can show the location and identification of pipes and cables. GIS-Based advantage and service management method will allow the consumer to see precisely place property and service are situated in the need of an hour. A utility map shows better visualization of utility network. This study aims to develop a utility map of Adoor municipal area with the help of GIS for the following utilities; water distribution lines, electricity distribution lines, drainages, optic fibres and traffic signals.

Keywords: GIS, Utility management system, Utilities

1 Introduction

The number of population living in downtown regions is growing everyday, and by 2050, it is expected that this number will have doubled. The lack of a comprehensive utility plan and administration could complicate the civil engineering projects. A utility map is necessary to ensure safety, aid in planning and development, assist emergency responders which is essential for the smooth and efficient functioning of modern infrastructure [1]. It can also make aware of the location of utilities during emergencies, in order to safely evacuate people and respond to emergencies. It can be easily shared and accessed by multiple stakeholders, engineers and planners [8]. This improves efficiency and reduce errors during construction phase.

Utility maps, which are made available in many authorities, are infrequently or improperly updated. Civil engineering fields have recently adopted the GIS (Geographic Information System) as a tool for a range of applications [3]. In as-assembled 2D drawings or 3D models, that change in terms of news abundance, positioning veracity, and storage plan, lines information of serviceableness is usually captured. Since GIS uses many layers to offer utility properties and urban-scale locations, it is useful for managing utility data. Utility map generation before GIS is difficult in its portrayal [2]. When using a GIS-based utility management system, the user will be able to pinpoint the location of assets and utilities.

It can be challenging to uniquely find on-site utilities because many municipalities have hardcopy maps of their existing assets and services [4]. These departments deal with substantial challenges every day in order to run and maintain the network and boost productivity. Every administrative entity that deals with utilities needs a dataset in geographical formats for successful utility management. The GIS-based utility mapping will give the authorities a useful tool for management and decision-making [7].



1.1 Characteristics of Existing Utility Maps

The existing utility maps have several drawbacks:

- The engineers have a very difficult time obtaining the utility information for planning and management because it is all kept in a whole separate location.
- Many authorities only have hard copy maps of existing utilities.
- Hardcopy maps are only available in physical format, making it difficult for multiple people to access the data.
- Hardcopy utility maps are difficult to carry around to different sites [10].
- Maps are printed at a fixed size, making it difficult to understand specific details [9].
- Hardcopy maps cannot be easily cross referenced.
- There will be risk of damage or loss of information for hardcopy utility maps, making it difficult to update or replace.
- Utility maps may not always contain complete information about all the utilities in an area [6]. This is because the maps are usually created from multiple sources, some of which may not be up-to-date or accurate.
- Available utility maps are outdated or rarely updated [5].
- There is lack of linkage between spatial and non-spatial utility data.
- Utility data is not centralized.
- Some utility maps may only show a limited range of utilities, this can make difficulty to identify the overlaps between different utility [6].

1.2 Characteristics of developed utility maps

- It had highly accurate information about the location of utility infrastructure.
- Utility maps can be integrated with other mapping systems and data sources to provide a more comprehensive view of the area to be mapped.
- It requires specialized software and hardware for collection, storage, and management of data.
- These maps can be accessed from a variety of devices and locations, this allows users to access the maps during project execution.

2 Study Area

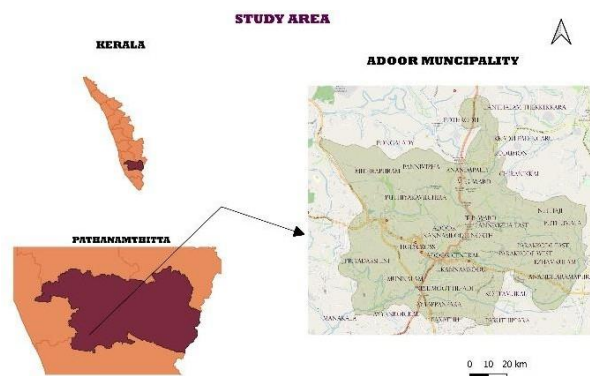


Figure 1: Study area

Adoor is a municipality located in the southern part of pathanamthitta district. Adoor is a significant municipal centre in Pathanamthitta District, Kerala. The municipality is situated halfway between the important towns of Trivandrum and Kochi. Adoor is relatively small municipality with a population of

around 30,000 people. Adoor Town is the current name of the region that once belonged to the Adoor municipality. The municipal area is surrounded by panchayaths of Panthalam, Thekkekkara, and Kodumon in the north, Enathu in the south, Ezhamkulam in the east, and Pallickal in the west border the municipality of Adoor. The municipality of Adoor has 28 wards. It spans over an area of 20.82 sq. km. (8.04 sq. m), is situated at 9.20°N 76.76°E. Adoor is located at an average elevation of 29 meters above sea level. The topography of Adoor is mainly flat, with gentle undulations in some areas. Only 10% of the society lives in city areas, accompanying the most (almost 90%) reside suburban extents. Map of Adoor municipality is shown in figure 1.

3 Methodology

3.1 Defining area of interest

Determined the scope of the mapping project in Adoor municipal area. Identified whether a utility map is available for Adoor municipal area. Also identified existing utilities and the area where utilities are likely to be present in Adoor

municipality. Contacted different departments which are involved in holding relevant data and drawings to find out whether utility maps are available for those particular utilities.

3.2 Analysis of selected area

Adoor municipality is divided into several wards for administrative purposes. Identified the administrative boundary of Adoor municipal area and also determined the boundaries of the area to be mapped. It spans over 20.82 sq. km and consist of 28 wards. Also conducted visual inspection to identify the topography of selected area.

3.3 Collection of departmental drawings and data from different authorities.

Gathered relevant data and drawings from responsible authorities such as KSEB, KWA, PWD and municipality then it is organized. Hard copy maps of electricity distribution lines and ward wise map of Adoor municipal area were collected from Adoor KSEB and municipality. Data of drainages in the municipal area were collected from PWD. Softcopy map of water distribution lines were also collected from Adoor KWA. Routes of Kerala Fibre Optic Network (KFON) is obtained from their official website.

3.4 Field survey

Before using the information collected from different authorities it is necessary to conduct field surveys to confirm the location of utilities. It allows for the collection of accurate and up-to-date information about the location of utilities. Location coordinates of different utilities were collected using GPS essential mobile application and names are given. Tracks of drainages are also marked.

3.5 Preparation of digitized land base maps

After inputting the data in ArcGIS 10.3.1 and QGIS 3.10.10, digitized base map was prepared where boundaries, open spaces, ward boundaries, are represented using points, lines, or polygons. This software will allow to create and edit spatial data, also helps to generate maps. Information about buildings and other infrastructures were obtained using OpenStreetMap-based navigation app.

3.6 Generation of utility map using GIS

Map is created by selecting the layers and choosing the appropriate symbology and labelling options. Nonspatial data are linked to the spatial data to generate various maps. Nowadays mapping is necessary in city planning and managing. GIS modelling offers a flexible interactive system which provides best visual

interpretation of data. The utility data with other GIS data such as terrain models, building models are integrated.

3.7 Analysis of generated maps

Generated utility map can be visualized in real-time to identify errors and inconsistencies.

4 Result and Discussions

- Utility map for Adoor municipal area was mapped using ArcGIS.
- There were almost five types of utilities in Adoor municipal area which includes electricity distribution lines, water lines, traffic signals, drainages and optic fibres as shown in figure 2,3,4,5&6.
- Mapping all utilities provide real-time solution for identifying locality on ground and quick time problem solving.

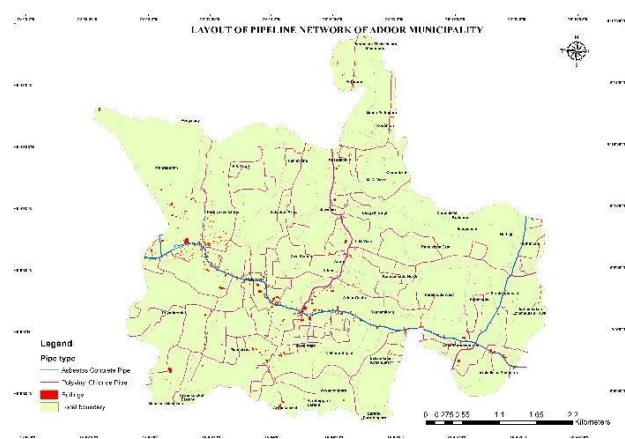


Figure 2: Generated map of pipeline network

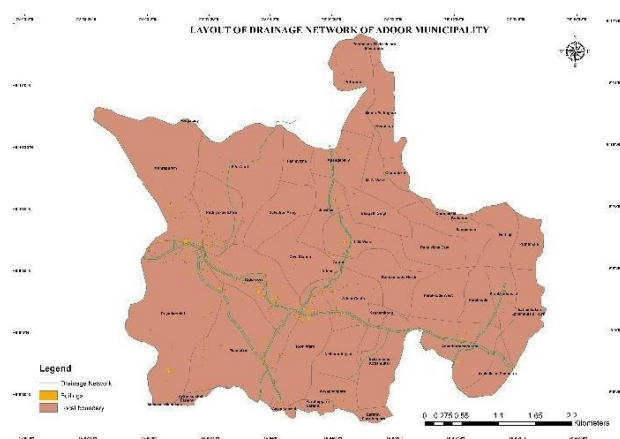


Figure 3: Generated map of drainage network

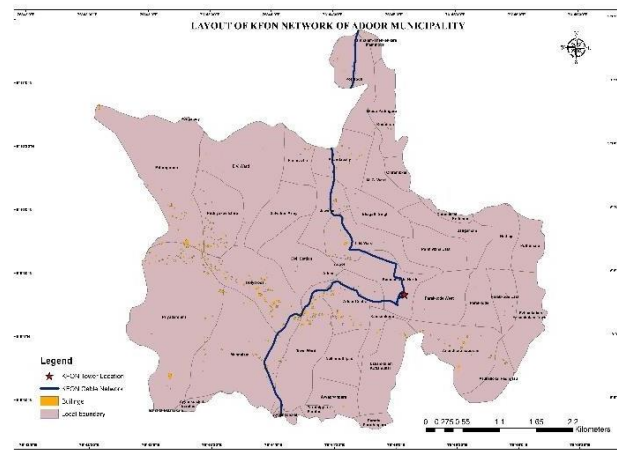


Figure 4: Generated map of KFON

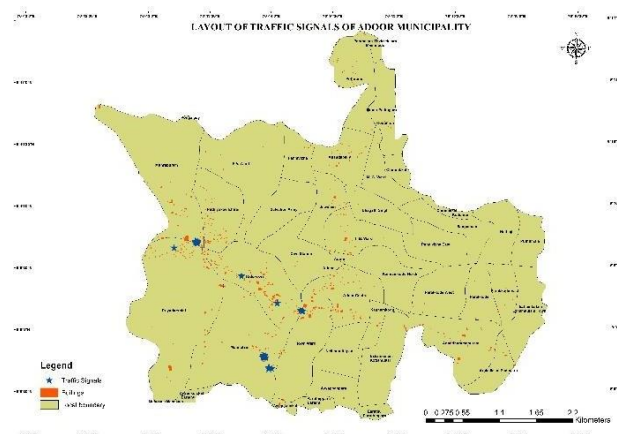


Figure 5: Generated map of location of traffic signals

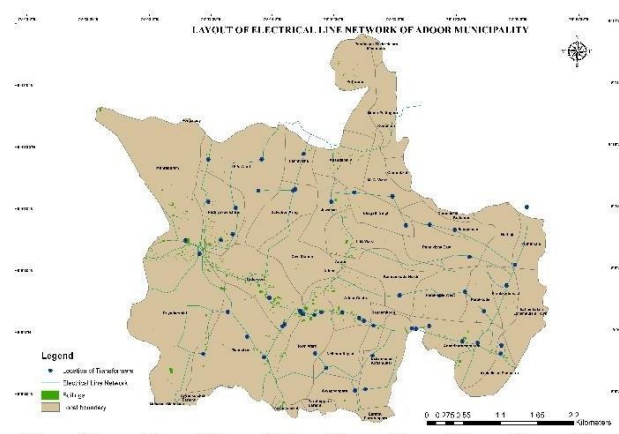


Figure 6: Generated map of electricity distribution lines

5 Conclusions

- The grown serviceableness map can support a wide range of evidence for miscellaneous types of analysis by diplomatic engineers, specialists, and different experts.
- Generated utility map helps to identify routes of particular utilities in Adoor municipal area.
- Generated utility map makes the data sharing and access quickly.
- These maps can be updated by adding new data which provide more detailed information and outdated

data can be removed.

- These maps can be updated to use as flood maps which helps in land use planning.
- Developed utility map can be re-analysed to update information based on changes in the landscape.

6 Declarations

6.1 Acknowledgement

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6.2 Publisher's Note

AIJR remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

How to Cite

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