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CityLayers: A GIS Integrated Framework towards the Sustainable Smart Cities Approach

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Abstract- The advent of smart cities aims to alleviate the challenges concerned with the ongoing urbanization and rising population density. To achieve the necessary degree of sustainability, government is looking for smart and efficient solutions for effective smart city data management. Such smart city decisions are based upon near real-time handling of a city's needs, proper planning and better finance in various municipal sectors. This requires a need for a new generation GIS enabled Decision Support System (DSS) for more efficient Municipal e-Governance. In order to enable holistic planning and functionality of a city with high visual impact, municipalities, especially in developing countries, often lack proper integrated tools to analyse their broad spectrum of information. To address these issues, the present study strives to provide holistic solutions to the e-governances, by the virtue of Information Computing Technology (ICT), on the basis of a developed product called CityLayers, which is fully integrated with e-Governance applications. The product has been established using open source technologies and has been customized to handle vast Municipal datasets with effective geo-data visualization. The product is compliant to Open Geospatial Consortium, and is a cross- platform, cross-device in nature providing quick access to spatial data, visualization and analytical capabilities over a web browser.

Keywords- Smart cities, Open source technologies, ICT, E-governance

I. INTRODUCTION

The efficiency of Geographic Information System (GIS) has swiftly expanded its way into various domains viz., urban planning, design management, agriculture, photogrammetry, surveying, etc [1,2]. Besides, the recent advances in the field of GIS along with its integration with technology have led to an overall evolvement from cartography for surveying and planning to a schematic sustainable tech-savy tool to overcome the needs of the GIS scenario's [3]. Consequently, the amalgamation of the GIS with urban development has led to the rise of the new global trend of "sustainable urban development" [3]. Such sustainability in the urbanization sector has now provided cutting-edge technical solutions catering to the needs of smart city management. Accordingly, the concept of smart cities is driven by technology-dependent initiatives with an aim to develop the city models; in a more concise, strategic, integrated, sustainable, and manageable city structure [4,5] targeting an overall enhancement in the city's intelligence and qualitative index of life.

Several cities, including Putrajaya (Malaysia), Songdo and Incheon (Korea), King Abdullah Economic City (Saudi Arabia), GIFT City, Lavasa City, and Nano City (India), Wuxi Huishan and Dongtan and Meixi (China), Dubai Waterfront, Dubai Central, Masdar (UAE), Living PlanIT Valley (Portugal), Neapolis (Cyprus), and Skolkovo (Russia), have master planned the art of sustainable urban development and has been sheltered under the umbrella of smart cities project [3].

Pertaining to the Indian context, similar amendments are being taken into consideration to develop 100 smart cities across the country in collaboration with the respective state governments and urban local bodies (ULB). Since, the work domain for municipalities and various other ULB are often restricted to geographic locations viz., utility networks, streets, disaster management, land and estate management,building permissions, tax assessment, collection and enhancement etc., they tend to face huge challenges in maintaining data quality and integrity owing to the lack of digital data management and schematic approach.

In the lacuna of the same, GIS turns out to be the most quintessential approach towards the recent advances in the development of sustainable urban models; which has now garnered the interest of the various municipal corporations and ULB. It serves the municipal officials with the facility to plan the assests and utility planning viz., infrastructure planning, land use planning, water distribution, and planning, town development and planning, as well as community development, administration and licenses and approvals for the city.

Problem Statement: Although, several attempts have been made to assess Web-GIS applications, there exists no consensus to evaluate the standard framework as majority of studies are area-specific or usability-based. The detailed exempleries of the same includes case studies of Lavasa smart city, Maharashtra, Gujarat International Finance Tec-City (GIFT City), Gujarat, and city of Dehradun in

Uttarakhand, India providing an overview of GIS applications for smart cities management in coherence with renewed levels of accessibility and functionality for municipal bodies using Free and Open Source Software (FOSSGIS) [3,6,7]. Interestingly, the web GIS applications developed with FOSS provided a customized interface for visualization, analyzing and data sharing.

Besides, an attempt has been made to provide a framework for GIS enterprise in association with sustainable urban development and projection of smart cities implementation. [8] provided three main factors viz., business functions, tasks and data requirements for the development of the IT solutions; amalgamated with GIS applications for effective smart city functionality of Saudi municipalities. However, the study highlighted the need for a unified municipal data modal through GIS as an enterprise medium. Thus, studies are now being inculcated to integrate GIS platforms for city planning and development for the efficient functioning of the city modal systems. Such unique city modal systems are significant enough to infer various dimensions to the city planning and development with regard to traffic control, drainage system and various other applications, thus improving the efficiency of city government and their administrative smart city management [9]. Contrastingly, an exemption has been made by developing Service-Oriented Architecture (SOA) with an aim to provide spatial data access within the government intranet; by integrating with user-based applications [10]. Thus, development pertaining to smart city management are still marred using Open Geospatial Consortium (OGC) for web based GIS platform and requires a robust approach.

Related Work: The case study of Zagreb in Croatia, demonstrates the visualization of huge spatial datasets using open source technologies [11]. Similar attempts have been made by Surat Municipal Corporation (SMC), Gujarat, India, in designing, developing and implementing a web based GIS application for better governance of smart cities and municipal datasets followed by an improvised operational efficiency. The web-based GIS application was developed using indigenous technology like Integrated GIS (I-GIS) and Image Processing Software by ISRO, Government of India, in collaboration with (Scanpoint Geomatics Ltd.).[12] demonstrated the development of a mobile GIS property survey application using open-source software tools and mobile mapping services for the real time capture of property data. Thus, inadequate studies have emphasized upon the integration of web based GIS platform for the successful operational smart city database management.

Objective: The present paper aims to demonstrate an aboriginal developed solution, namely "CityLayers" for the smart city database management, using an open source technology system. The product has been specfically catered to serve to the needs of the Urban Local Bodies or municipal datasets for better and systematic management of their datasets. The datatsets provided are further visualized in an effective manner onto the geoportal which has been described later, in detail.

Motivation: Subsequently, owing to an increased stake of e-governances coherent with the recent emerging trends in information technology, the governance processes are now evolving from e-governances to g-governances, thereby enabling decision makers to initiate smart decisions for enhanced geospatial services. Municipalities, especially in developing countries, often lack integrated tools to analyze the broad spectrum of information in order to enable holistic planning and functionality of a city by understanding local needs with high visual impact.

II. "CITYLAYERS: AN INDIGENOUS PLATFORM TO SMART CITIES MANAGEMENT"

Considering the need of the hour and with a vision to ameliorate g-governance for sustainable development, Nascent Info technologies has developed a GIS-based product named CityLayers that meets the entire requirement for municipal g-governance including a holistic visualisation with insights for efficient decision-making. CityLayers by its virtue not only provides a bird's eye view of the city as a whole or as part of municipal sector but also facilitates the decision making process through its highly powerful data analytics capabilities to various departments. The product is a compliance to Make in India initiative following the guidelines of Ministry of Electronics and Information Technology (MEITY).

The product CityLayers consists of following components:

- A Departmental GeoPortal equipped with Intranet-based solution for municipalities.
- A Citizen Portal.
- Facility for Data Update using a QGIS against LDAP authorization and authentication.

CityLayers is a cross-browser, cross-platform and cross-device product integrated with various e-governance applications serving multiple departments. This present paper mainly focuses upon the CityLayers Departmental Geoportal.

III. METHODOLOGY

The methodology followed for development of the CityLayers product is given in Fig.(1). The product '*CityLayers*' is a service-oriented designed application based on OGC standards such as Web Map Service (WMS), Web Feature Service (WFS)/WFS-T and Tile Map Service (TMS). It is based upon client-server architecture which has the following four tiers:

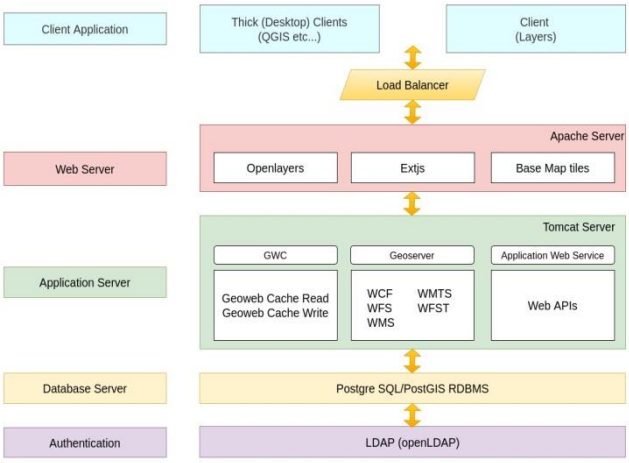

Fig.1 A schematic representation of the CityLayers detailed architecture.

i) Authentication Tier

The authentication tier uses LDAP (Lightweight Directory Access Protocol) as the security medium for the authentication of the provided datasets. LDAP has been basically used by the users for the validation of the CityLayers components such as Departmental Geoportal, Data updation, and for authentication against the mobile survey application which also provides the data. However, the assigned user rights and their roles are managed by admin portal which is further authenticated at LDAP level.

ii) Database Tier

In CityLayers, the database tier stores the spatial and non-spatial data in a normalised state. The spatial inheritance has been implemented at the database end which allows homogeneous and heterogeneous spatial data accessibility. The database import functionality design has been specifically developed to load the spatial and non-spatial datasets of any municipal corporation. Since, its difficult to load the spatial datasets in the normalised form, the data import model has been developed within the admin panel module.

Furthermore, the client- server architecture was subjected to various softwares, libraries and extensions for the development of the CityLayers. This includes:

I. PostgreSQL and its extensions such as PostGIS, PgRouting, Pg_trgm, Tablefunc for database management.
II. GeoServer and its modules such as Mapfish Print, Key Authentication, YSLD, JAI and ImageIO for the styling and publishing of the imported layers/datastets.
III. Java (Springboot)
IV. ExtJS
V. OpenLayer
VI. Apache Tomcat
VII. Apache Web Server
VIII. GDAL
IX. Ogr2ogr
X. LDAP (ApacheDS / OpenLDAP)

iii) Application Logic Tier

The application logic tier is a bridge between the user interface and the underlying database, containing interoperable web services. It also consists of GeoServer which handles the map-related requests, which are mainly in the form of WMS, WFS/WFS-T. The non-spatial data requests are handled through REST services that have been developed within the Java using springboot framework.

iv) Presentation Tier

Initially, the intuitive user interface of the CityLayers has been developed using the JavaScript frameworks. The ExtJS frameworks are further responsible for the development of the various modules of the Departmental Geoportal. This is inclusive of the Layer Switcher Module, Query Module, visualization of the Attribute grid table, Dashboard module and the form generation in the Plan, Dig, Monitor (PDM) module. In addition to the same, several other map based modules such as Editing/ Validating Tool has been developed using Q-GIS and OpenLayers.

IV. RESULTS

The developed product vignettes the various modules of the CityLayers Departmental Geoportal. Interestingly, the demonstrated Geoportal is another component of Layers' solution that enables the users to view , analyze and query the spatial and corresponding attribute information. The departmental geoportal is capable of providing several functionalities such as data importing, data editing, querying, generating and printing reports, viewing summarized dashboard and exporting relevant data and maps as per the client requirement thereby proving to be a spatial decision support system . In addition to the same, the Geoportal also comprises of various other basic (Table.1) as well as Advanced GIS tools as described below :

Sr. No	Feature	Description
1.	Basic GIS Tools	These tools can be used to easily access the map . These include Zoom IN, Zoom Out, Zoom to Box, go to coordinate, PAN, Map Overview, Full-screen map, Scale-bar, Selection by feature , measurement tools.
2.	Fuzzy search	It allows users to search and locate the records that match partially or completely based on any provided keyword.
3.	Export Data	The user can also export all / queried attribute data in the form of an excel sheet.

4.	Editing/ Validating	It also facilitates editing and validation of attribute and spatial data which includes • Insert • Delete • Split • Merge • Move
5.	Information Toolbar	It will facilitate on click display of information about the features.
6.	Map Print	The map view can be printed / saved as a pdf based on any predetermined template.

A Login: (Fig.2) depicts the login screen of the Geoportal. Once logged in, a welcome screen appears, which consists of the following components:

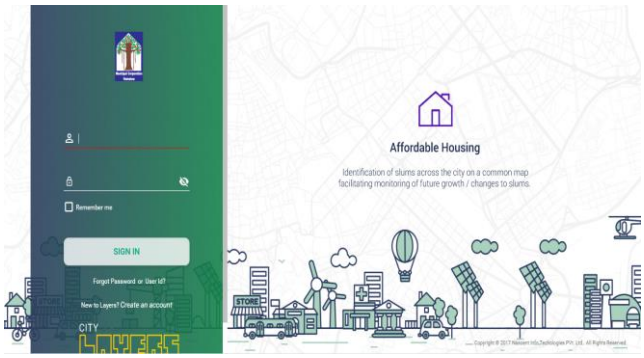

Fig.2 An illustration of the CityLayers Geoportal Web Login page.

B Map Section :
This section allows the user to view and interact with the published basemap or hybrid map along with assigned overlays. Both basemap and hybrid maps are made available through Tile Map Service (TMS) specification of OGC which are served in XYZ tile format. Besides, the portal also illustrates visuals of a schematic map print options with detailed functionalities such as presence of a scale bar, mouse position, north arrow, and full screen map extent.

C Basic GIS tools: The Basic GIS tools existing within the Geoportal majorly consists of the tools meant for navigation within the map area. This is inclusive of features such as Zoom In, Zoom Out, Zoom to Box, Zoom to Scale, Pan, Map Overview, Navigation History, Selection by Feature, Information Tool, Measurement tool and My Location Feature.

D Functionality Menu Bar

Analytical Capabilities: The designed Geoportal mainly provides two kinds of analytical capabilities.

i. MIS analytics which is performed on the attribute data of the feature. This is also congruent with the Query feature module wich allows the user to perform the user specific query on a single attribute. Subsequently, an advanced Query module within the Geoportal also allows users to perform the multiple attributes.

ii. Spatial analytics allows spatial operations to derive the decisions enabling the spatial relationships between the layers. The feature allows the user to run the query module on a source layer (single layer) and as well as on the mask layer (multiple layers) in coherence with combination in spatial operations and user's area of interest.

Bookmarks: This tool facilitates users to save, view, edit, and execute the saved query in order to retrieve the datasets.

Attribute Grid: The Attribute Grid shows user the attribute information of the features available in the map view (extent). It has facilities like zoom to feature, column-wise filters, sorting of the data and summary information for the attribute. It also allows users to export current extent and all the data in excel format.

Layer Management: The Layer Management feature provides information about the assigned layers visible onto the Geoportal module with a unique functionality to enabled/disabled the assigned operational layers. The Layer switcher module (Fig.3) provides the list of the layers viz., 1) Operational Layers 2) Supported Layers 3)Administrative Layers. The Operational Layers are the one which has been assigned to function on the existing geoportal module while the supported layers consists of the list of the layered datasets which has does not belong to the same department/organization but enacts as a supportive dataset. Meanwhile, the Administrative Layers (eg. Zone and Ward Layers of an area of interest) consists of the main layered datasets; responsible for providing the basic maximum detailed information onto the module.
The Layer Management module also allows the user to dynamically change the styling of the operated layers.

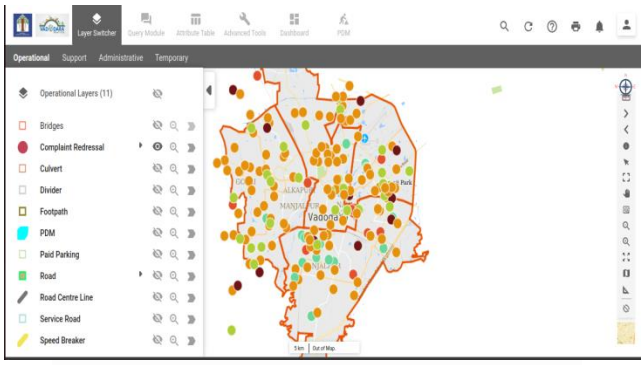

Fig.3 A detailed infomation on Layer Switcher Module consisting of the Operational Layers, Supportive Layers, and the Administrative Layers. The figure represents the list of the Operational layers imported onto the CityLayers module for the effective visualization of the datasets.

Dashboard: The Dashboard module (Fig.4) gives the graphical representation of the imported operational datasets accessible to the user in the form of bar charts and pie charts. This module is significant to denote the statistical information about the datasets within the area of interest and also helps to monitor the project by generating the automated reports.

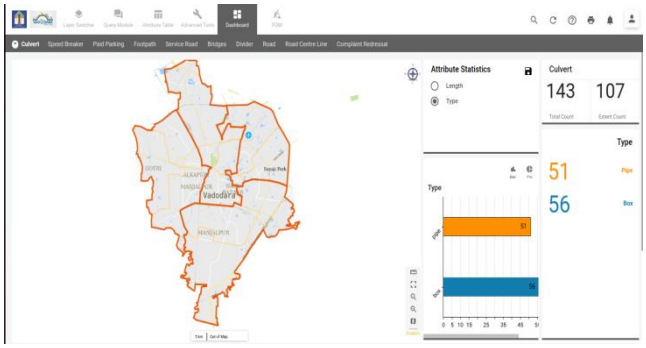

Fig.4 An illustration of the Dashboard module denoting the information of the imported datatsets in the form of graphical chrats, histograms etc.

Advanced Tools: The Advanced Tools module consists of various options such as Buffer Operation for proximity analysis, Measurement Tools, Routing module based upon pgRouting extension. The routing feature allows the user to determine the nearest navigation routes, using the shortest path algorithm (pgr_dijkstra) using user defined starting and ending points (Fig.5). The Advanced tools option is also equipped with a Network Tracing module. The tool allows the user to trace the upstream or downstream directions of any utility network dataset like water and gas pipeline etc. Based on the input starting location the CityLayers application will highlight the upstream or the downstream network direction over the map (Fig.6). There are functionalities available such as Selection Tool for selection of the feature, Fuzzy Search which allows the users to search and locate the records based on the provided keyword and facility to reset the map to the default view. The Advanced tool feature also comprises of a Print view option which allows rhe user to print and save the map view based on a predetermined template.

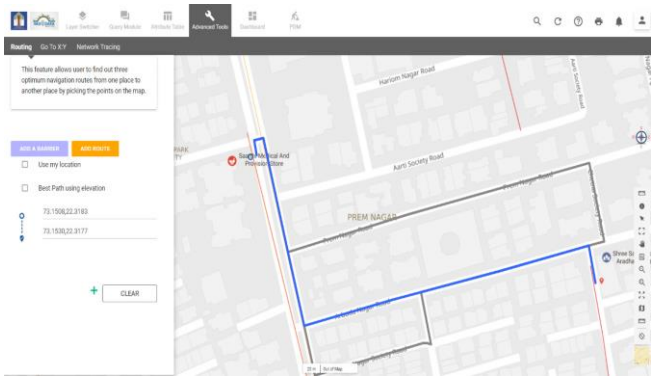

Fig.5 A schematic representation of the Advanced tool feature within the CityLayers product. Routing module0 showcasing the navigation route from one point to another as per the user requirements

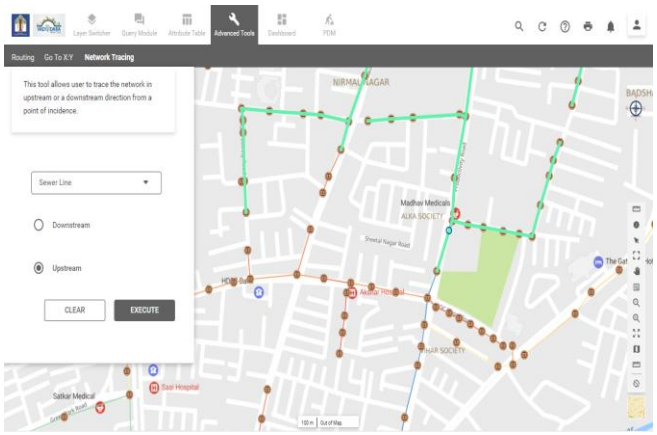

Fig.6 Network Tracing module within the CityLayers product denoting the upstream and downnstream network direction of a utility dataset.

Plan, Dig and Monitoring Module (PDM): Municipal corporation carries out various activities in different parts of the city in the interest of citizens such as maintenance, upgradation of utility network, infrastructures like roads, footpaths, etc. along with agencies like Electricity Board, Telecom, Gas. The visibility of work being carried out and its status is not readily available to decision-making authorities of the corporation. PDM module helps to manage, control such important functionality of corporation. PDM aims to aid the road cutting agencies and the road owning agencies to streamline their area of work by eliminating all manual work and gaining online access to all data and information related to the work, right from sending a new request to the completion of work (Fig.7).

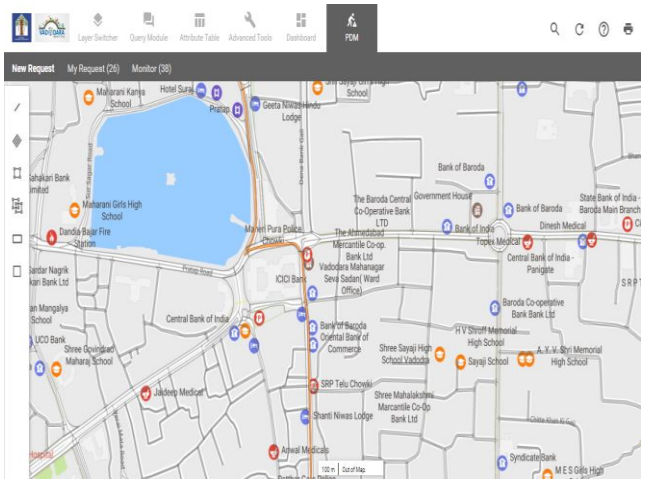

Fig. 7 The integration with Plan, Dig and Monitor systems further enables the users and administrator to plan their activities in a schematic manner.

V. DISCUSSION & CONCLUSION

The present study deals with the development of the CityLayers product which is a unified portal towards an efficient and web based management of the municipal datasets and smart city operations. The product is an enterprise scalable Web-GIS application, providing

schematic organization of the databases at the application level. Interestingly, the developed product is the part of a broader vision of the "Layers product"; designed primitively, compliant to various domains across the Indian sub-continent. Consequently, the illustrated product vignettes the various modules for an efficient smart city functionality. The Layer switcher module enables the user for an effective visualization of the datasets, while, the Query module enables the user with the facility of a constrained search of the operational datasets. The module has capability to perform both Atribute and spatial based query for the area of interest. Meanwhile, the imported and the queried datasets can be further viewed in the form of graphical illustrations such as histograms, pie charts etc within the Dashboard module. This module represents the statistical information about the datasets within the area of interest and also helps to monitor the project alongwith generation of the timely reports. Hence, the development of such modules are majorly used by the municipal bodies and other ULB for the schematic visualziation and vieweing of their datasets.

This is further well illustrated with the clientele profile; which demonstrates the installation of the CityLayers product at various municipal locations; exempleries of the same includes Ahmedabad Municipal Corporation (AMC), Vadodara Municipal Corportaion (VMC), Bhavnagar Municipal Corporation (BMC) Corporation across the Indian sub-continent. Furthermore, the product is compliant enough to demonstrate the multi- organization datasets, enabling both client and the user to understand the datasets in a schematic manner. This is well illustarted by the Layer switcher module which showcases the lists of the assigned operational layer onto the geoportal. The developed Query module, further , helps to determine the status of the utility networks, disaster management, building footprints, and various other utility services with the help of the Spatial Attribute query module. Hence, CityLayers is a product which satisfies the municipal corporation GIS requirements by providing a departmental geoportal for internal use, citizen portal for public use, a mobile-based application for property survey, alongwith the centralized data repository system with an inbuilt capability wherein the datasets can be edited and validated through QGIS against LDAP. It facilitates the flow and exchange of municipal information by significantly improving the data availability, interoperability and its consistency across various software systems and various departments. Moreover, its compliance with the OGC platform as per Digital India policy probes to be the significant step towards contributing to India's Smart Cities mission. However, the developed product is the first version of the CityLayers, which is being streamlined simultaneously with enhanced integration capabilities such as Enterprise Resource Planning (ERP), Internet of Things (IoT), SCADA, Vehicle Tracking System (VTS) in the existing network of framework alongwith simultaneously working upon the improvement of data visualisation. Future integration of utility networks with SCADA system will provide the real time data visualization in coherence to determination of pressure flow, and measurement of various water quality parameters. Subsquently, there is also a need to develop an advanced admin portal which can handle the meta-data section of CityLayers. Furthermore, the future development of CityLayers also includes thematic data visualization, 3D visualisation, on the fly style changes by users through styling tools alongwith various other analytical modules.

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REFRENCES

[1]. D. J. Maguire, "An overview and definition of GIS". Geographical information systems: Principles and applications, Vol.**1,** No.**1**, pp. **9-20, 1991.**

[2]. V. Maliene., V. Grigonis., Palevičius., & S. Griffiths, "Geographic information system: Old principles with new capabilities".Urban Design International, Vol.**16,** No. **1**, pp.**1-6., 2011.**

[3]. A. Tiwari., K. Jain, "GIS Steering smart future for smart Indian cities", International Journal of Scientific and Research Publications, Vol.**4,** No. **8**, pp. **442-446**, **2014**.

[4]. P.A.Johnson., A. Acedo., P.J. Robinson., "Canadian smart cities: Are we wiring new citizen-local government interactions?", The Canadian Geographer/Le Géographe canadien, Vol. **64,** No. **3**, pp. **402-415**,**2020**.

[5]. S. Qayyum., F. Ullah., F. Al-Turjman., & M. Mojtahedi, "Managing smart cities through six sigma DMADICV method: A review-based conceptual framework", Sustainable Cities and Society, Vol. **72**, pp.**103022**, **2021**.

[6]. D. Chakraborty., D.Sarkar., S.Agarwal., D.Dutta., J.R. Sharma, "Web based GIS application using open source software for sharing geospatial data", International Journal of Advanced Remote Sensing and GIS,Vol. **4,** No. **(1)**, pp. **1224-1228**, **2015**

[7]. P. Garg, "Development of an approach for Municipal GIS", IJCEBS Vol.**3** , **2015**.

[8]. W.A. Abdulaal, "Framework for enterprise GIS for Saudi municipalities", International Journal of Geographical Information Science,Vol. **23,** No. **6,** pp. **687-702, 2009**.

[9]. M.A. Kamal, "City planning and development using geographic information systems, 11th International Conference on Computer and Information Technology pp. **31-35**, **2008.**

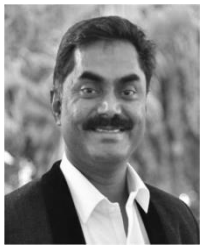
[10]. P.M. Li Zonghua, "A SOA-based Approach to Geographical Data Sharing", International Symposium on Spatial Analysis, Spatial-Temporal Data Modeling,and Data Mining . Wuhan, China, **2016.**

[11]. M. Miler., D. Odobasic., D. Medak, "An Efficient Web-GIS Solution based on Open Source Technologies: A Case-Study of Urban Planning and Management of the City of Zagreb, Croatia", In FIG Congress Vol. **16**. Australia: Sydney, **2010**

[12]. V. Neene, M. Kademba, "Development of a Mobile GIS Property Mapping Application using Mobile Cloud Computing", International Journal of Advanced Computer Science and Applications, Vol. **8** No. **10 ,** pp. **57-66, 2017.**

AUTHOR'S PROFILE

Maulik Bhagat is a Technocrat and an Entrepreneur in multiple domains. He is a keen planner and strategist with abilities of conceptualizing, framing and implementing projects in multiple domains. He holds a master's degree in BE (ICT) with more than 16 years of Entrepreneurship experience. With the intention of touching the lives of common citizens, he has lead the development of an indigenous GIS platform "CityLayers" that is useful to the Smart Cities for managing the daily operations in a very cost effective way. This initiative is also in tune with various initiatives of the GOI towards like "Atmanirbhar Bharat", "Vocal For Local", "Make In India". These initiatives have helped in drastic reduction of the Total Cost of Ownership for GIS solutions, thus can help in the increased adoption of the GIS technology in the country.



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