Role of Remote Sensing: Creation of Smart Cities in India

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Abstract— As India's population continues to grow more citizens will move to cities. Experts predicted that about 25-30 people migrates every minute to major Indian cities from rural areas in search of better live hood and better lifestyle. It is estimated that by year 2050, the number of people living in Indian cities will touch 843 million. To accommodate this massive urbanization, India need to find smarter way to manage complexities, reduce expense and improve the quality of life. Government of India has allocated 70.6 billion rupees for smart city budget 2014-15. India plan 100 new smart cities and will developed modern satellite town around existing cities under smart city program. Based on "digital city", smart city is widely used in daily live hood, environmental protection, public security, city service and other field. In this paper, the main focus is on recent research and concept of "smart city", the work summarizes the relationship between 'smart city' & 'digital city' putting forward main contents of application system. This paper describes importance and difficulties of construction of "smart city". Integrated approach to modernize city infrastructure and leverage technology should be made to make city smart. Digital Master Plans have to be dovetailed into city master plan. This work also emphasizes on the use of different dimensions of GIS (Geographic Information System), Remote Sensing (RS), GPS (Global Positioning System). This concept assists in visualizing the complex pattern and relationship that characterized real word planning & policy problem. Visualization of spatial pattern also support change analysis. Such work contributes in monitoring of social indicator. This turn result in improving need assessment for developing smart cities. Smart cities are helpful in improving water management, waste management, safety, transport, energy, healthcare, education.

Key words: GIS, RS, GPS, Urbanization, Smart City, Digital City

I. INTRODUCTION

India is one of the developing countries in the world with a population of 1.29 billion approximately. It ranks second most populous country in world; while china is at top have population 1.40 billion. India represents almost 17.37% of world population in Fig. 1. India is predicted to have more than 1.53 billion people by end of 2030. About 72.2% of population lives in some 6, 38,000 villages and rest 27.8% in about 5,480 towns and urban agglomeration. Due to increase in India's population, more citizens are moving to cities. Expert predicted that about 25-30 people migrate every minute to major Indian cities from rural area in search of better live hood and better lifestyle. It is estimated that year 2050, the number of people living in Indian cities will touch 843 million to accommodate the massive urbanization.
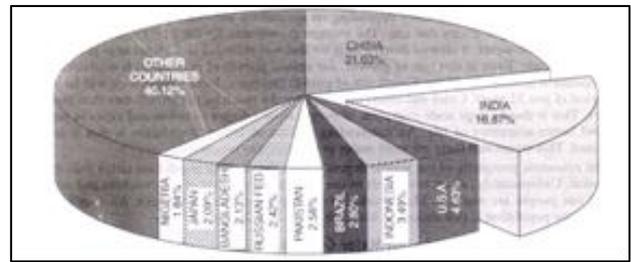

Fig. 1: India in World Population

Therefore, India must need to find smarter way to manage complexities, radios expresses and improve quality of life. Government of India has allocated Rs.70.6 billion for smart cities budget 2014-15.India plan 100 new smart cities and will developed modern satellite towns around existing cities under smart cities program. This paper focuses on "Smart City" concept, what has a relation with digital city. It also describes the role of remote sensing in creation of smart cities [1] [2].

II. MOTIVATION

The city is a government unit which is growing increasingly larger, complex and important as the population ranks of urban areas. By 2030 this number is expected to increase. With the rapid increase of the urban population worldwide, it faces a variety of risks concerns, and problems. The unprecedented rate of urban growth creates urgency to finding smarter ways to manage the accompanying challenges. Researchers has recognized gap in developing the concept of smart city. Considering the gap, some questions have raised. What are main characteristics of smart cities? In what aspects do people states that some particular cities as smart cities? Why is smart city being identified as a novel concept? What leads to the success of a smart city initiative? This paper tells an idea to indirectly answer these inquiries, fill the research gap, and conceptualize smart city [3].

III. LITERATURE REVIEW

Smart city defines as "one where investment in human, social, capital, traditional transport and modern Information And Communication Technology (ICT), infrastructure, sustainable, economic development provide a high quality of life by engaging management of natural resource, through participatory action". The concept is still under development and evolution as a new approach to urban development and management. Smart city is one which provides for wellbeing of the people through integration of urban planning system, efficient service delivery, smart governance, energy management and conservation of resources with underlying use of technology and instrumentation leading to social economic and sustainable development. The vision of ministry of urban development is to facilitate creation of economically vibrant, inclusive, efficient and sustainable urban habitat. Consistent with the vision the mission is to "promote cities of economic growth through improvement in

the quality of urban life by facilitating creation of quality urban infrastructure with assured service level and efficient governance".

Smart City, is important strategy of IBM, mainly focus on applying next generation information technology to all walk of life, embedding sensor and equipment to hospital, power grid, railway, bridge, tunnel, road, building, water system, dam, oil and gas pipelines and other object in every corner of the world and forming "internet of thing" via internet concept of smart city is a minor step toward taking world to smart planet interconnected to each other [1].

Many researchers used the concept of Smart cities in different sections. There are various definitions of Smart Cities in literature and the phrase "Smart Cities" has been used in many different situations and by different people [4]. The review presented in this paper is an analyzed existing literature in order to provide a framework to define the Smart City concept. Reviewing the literature shows that the concept of Smart City has been developed in three main areas: (i) Academic, (ii) Industrial, and (iii) Governmental.

A smart city is called as a city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rail/subways, airports, seaports, communications, water, power, even major buildings, can better optimize its resources, plan its preventive maintenance activities, and monitor security aspects while maximizing services to its citizens[5]. It is an integrated approach to helping entire communities go on-line to connect local governments, schools, businesses, citizens, and health and social services in order to create specific services to address local objectives and to help advance collective skills and capacities [6]. It is the one that capitalizes on the opportunities presented by Information and Communication Technology (ICT) in promoting its prosperity and influence [7]. An environment that is able to acquire and apply knowledge about its inhabitants and their surroundings in order to adapt to the inhabitants and meet the goals of comfort and efficiency [8]. Key conceptual components of Smart City are three core factors: technology (infrastructures of hardware and software), people (creativity, diversity, and education), and institution (governance and policy). Given the connection between the factors, a city is smart when investments in human/social capital and IT infrastructure fuel sustainable growth and enhance a quality of life, through participatory governance [9]. This concept is connected to notions of global competiveness, sustainability, empowerment and quality of life, enabled by broadband networks and modern ICTs. Its implementation requires the development of migration paths regarding Internet infrastructures, test bed facilities, networked applications, and stakeholder partnerships [10]. As per the literature survey, it is found that there are some key points common to build a smart city.

A. Relation between Smart Cities and Digital Cities

Digital city refers to taking remote sensing, global positioning system, geographic information system and other spatial information technologies as the main mean for constructing geographical information. Framework of digital city is used to build urban geographic information platform for public service. And through the construction of infrastructure,

development and integration of all kinds of geographic information, and achieving the network digitalization, intelligence of urban economy, social, ecology and other aspect of each operation can be achieved. This concept is on basis of comprehensive digital city, establishing visual and measurable urban management and operation with intelligence [10].

IV. MATERIALS AND METHODS

This paper aims to suggest a framework connecting conceptual variants of the smart city label, key elements for being a smart city, and strategic principles for making a city smart. Before proceeding for the actual components of the smart cities, each definition was analyzed against the six questions of the paper (why, what, who, where, when, and how) in Figure 2. This figure describes the knowledge of factors for developing smart city. The basic understanding must be developed as follows:
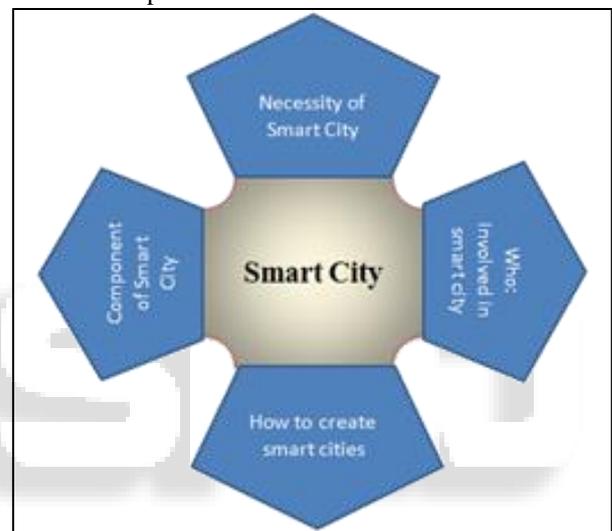

Fig. 2: Basics of development of smart city

1) Necessity of smart city: It is necessary to know about the advantage of developing smart city.
2) Component of smart city: the important components must be defined to build smart city.
3) Who are involved in smart city? : It is very crucial task to interpret the active engagement of people or institution or industry etc.
4) How to create smart city? : It is a conceptualization of the idea on paper. E.g. predict and forecast the role of ICT in smart city etc.

In developing smart city, Technology, Policy, Demand, Organization plays a crucial role. It has advantage with respect to community, economy, environment and governance. There are some fundamental components of smart city explained in figure 3 (SPSCSM- Smart Public Service and Construction of Social Management , SMT-Smart Medical Treatment, UBM- Urban Mangement , SSS-Smart Security and Sureveillance, ITAC- Smart IT and Communication, M- Management, EAGRI- E agriculture)as follow:
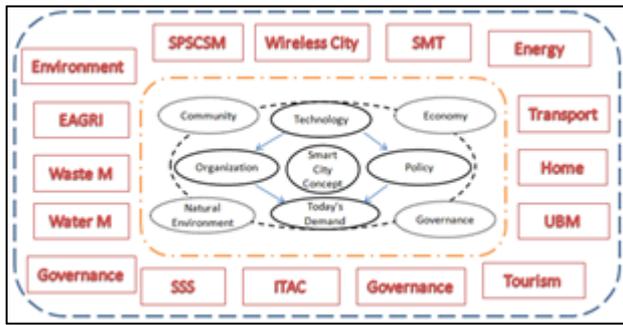
Fig. 3: Fundamentals of smart city

A. Construction of Smart Wireless City

On the basis of wifi, mesh, wimax technology and with further extension wireless broadband network can be built. At the same time wireless broad based station will cover whole city. And it will be helpful in many functions urban management and service system for Public business regional visitor's tourists and government agencies.The function includes mobile wireless video surveillance, mobile conferencing, mobile dispatching emergency response and emergency telecommunication [11].

B. Smart Public Service and Construction of Social Management

A social intelligent management system in a city can handles complaints, request, demand related to market, education, daily purpose etc. This is a one stop service system for government for collecting data in planning, emergency etc in real time situations [12].

C. Construction of Smart Medical Treatment

ICT can help hospitals achieve smart medical care and intelligent management of the medical material and support digital collections, processing storage, transmission and sharing of internet medical information, equipment information, drugs information, personal information and management information. The need of intelligent management and supervision can be achieved in the medical information, medical equipments and supplied intelligent management and supervision of public health and solving so many issues [13].

D. Construction of Smart Energy

Implementation of 8 smart grid pilot projects in India with an investment of USD 10 million, Additional of 88000 megawatts of power generation capacity in 12th five year plan(2012-2017) India needs to add 250 -400 GW of new power generation capacity by 2030. The power grid corporation of India Ltd has plan to invest USD 26 billion's in next five year India to install 130 million" smart meter" by 2021[13].

E. Construction of Smart Home

Smart Building: - As per the existing research it is found that India is expected to emerge as world's 3rd largest construction market by, 2020 by adding 11.5 million home every year. The intelligent building Management System describes reduction in the use of enegery, water, etc. Therefore, such aspects are included in smart Entertainment,

Phone Systems, Thermostats, Irrigation, cable and structured wiring, Pet care and pest control, video surveillance.[14]

1) Smart Home Design

A smart home is a house that has highly advanced automatic systems for lighting, temperature control, multimedia, security window and door operations, and many other functions.

2) Smart Structures

Smart structure is a global leader in wireless embedded data collector (EDC) solutions precast into concrete. Smart structure solutions improve the quality of bridge pilings and deep foundations and can dramatically alter the cost and time dynamics of traditional test pile programs by enabling real time testing of all foundation elements [15].

F. Construction of Smart Transportation

Green Transportation: - The government of India has approved a USD 4.13 billion plan to spur electric and hybrid vehicle production by setting an ambition target of A million vehicles by 2020 electric vehicle charging stations in all urban areas and along all states and national highways by 2027.

1) Railways

Metro: ministry of urban development plans to invest more than USD 20 billion on the metro rail projects in coming year's .High speed rail: The proposed 534 km Mumbai Ahmadabad high speed rail project will have an investment of around USD 10.5 billion. Monorail:- India's first project at Mumbai will cost around USD 500 million , of which USD 183 million has been spend on phase one. According to the needs and traffic situations every city can take good advantage of sensor network and established the smart traffic management system [16].

G. Construction of Smart Urban Management

In India, the complexity of urban development is so dramatic that it demands immediate attention and perspective physical planning of the cities and towns. The dynamic nature of urban environmental necessitates both macro and micro level analysis. Therefore, it is necessary to integrate remote sensing with urban planning and management in smart cities constructed in India. New approaches are required, and new methods must be incorporated into current practice. Remote sensing can provide an important source of data for urban management, such as land cover mapping and environmental monitoring, helps to finalize or settle down the upcoming problems of urban management [17].

H. Construction of Smart Tourism

Smart tourism is the only way to travel information. It should be based on the existing tourism information and infrastructure, taking good advantage of digital of digital information and the internet of things to achieve the establishment of a set of solution , which can consider and fulfil the management and tourism related task, such as tourism online service, management system of monitoring, collection of tourism information and service of smart city, smart tourism can be taken good advantage of to fully integrated tourism market, intelligent management system of monitoring , collection of tourism information and service of

smart city, and relevant info and service of enterprises to promote development of tourism [10][9].

I. Smart Governance

Investments of about USD 1.2 trillion will be required over the next 20 year across areas like transportation and energy and public security .in budget 2014-2015 USD 1.2 billion allocate for smart cities in India and FDI norm relax. USD 83 million allocated for digital India Initiative .PPP (public private partnership) model to be used to upgraded infrastructure in 500 Urban Area. Smart city Project will create 10-20% rise in employment [9].

J. Smart Environment

Ministry of new and renewable energy has planned to add capacity of 30000MW in 12th five year plan .Indian ministry of water resource plan to invest USD of 50 billion in water sector in upcoming years. About 67% of rural population continues to Defecated in the open, and India accounts for about 50% of world open defecation. World Bank has signed USD 500 million for rural water supply and sanitation [15] [11].

K. Smart Disaster Management in Smart Cities

The space technology and disaster mitigation communities work together in developing effective and accurate methods for prevention, preparedness and relief measure. Disaster prevention is long term phenomenon, which can be studied with the help of satellite monitoring of various relevant factors, such as changing land use. Disaster preparedness of impending disaster and often entails process, which are quite dynamic and result in "rapid onset" disaster are of this type although some, such as drought and famine are slow to develop. The obvious difference between warning and forecast is that latter is less specific in time and space. An important aspect in terms of satellite monitoring involves assessment during disaster. Satellite technology can also help in identifying escape routes and location for storage of temporary housing. The main role of remote sensing in Disaster management is to make people alert about disaster as much fast as possible, quickly assessing severity and impact of damages due to flooding, earthquake, oil spill and other disasters, planning efficient escape routes from coastal areas during hurricane seasons, charting quickest routes for ambulance to reach victims, locating places for shelter for victims or refugees. Other main operations performed are calculating population density in disaster-prone area, rapidly identifying hardest hit disaster area in order to provide early warning of potential disaster, pre disaster assessment to facilitate planning for timely evacuation and recovery operation during crisis [13][10].

L. Smart IT and Communication Smart Security and Surveillance

Cloud computing will evolve into a USD 4.5 billion market in India by 2016. Broad band connections to 175 million user's by 2017. The main motive behind is to connect the cities India as much as possible. Under the flagship "safe city" project, the union ministry proposes USD 33 million to make 7 big cities (Delhi, Mumbai, Kolkata, Chennai,

Ahmedabad, Banglore And Hyderabad) to focus on technology advancement rather than man power [14][17].

M. Smart Waste Management

With smart management system, it's easier to manage the collection of urban waste from your city. through the placement of sensor with low energy consumption and high durability in the traditional trash bins, it's possible to keep a tight control on the state of the container , its location and security , thus increasing the effecting the effectiveness and efficiency of the waste management teams. Urban waste can be seen as a resource for the whole processing chain. Encourage recycling, generate rate based on each citizen's contribution and make your city greener. The garbage bags used by each citizen allow the identification, meaning that the waste placed by them will be recorded in his user account. After confirming the contents of the bags in the selection phase of the waste processing company, these "points" can be used to calculate the rate of urban waste[15][16].

V. SUMMARY

In this paper we mainly focused on the components which important for construction of smart cities of India. And we have over reviewed some remote sensing uses in smart city creation. The methodologies we have over reviewed are smart monitoring in governance, waste management, safety purpose, and transportation, and energy, healthcare. To make cities in India smart we need an integrated approached to modernize city infrastructure, and leverage technology to improve efficiency and capacity of city services.

In this paper, the role of advanced sensing in smart cities was discussed. Arrays of applications in smart cities which can benefit from advanced sensing were described. These include infrastructure health monitoring, electricity and water distribution systems, transportation systems and surveillance, amongst others. The state of the art in each of the considered applications is reviewed and inherent challenges are highlighted. In a world where carbon emissions have to be reduced for greener living and sustainability is promoted, there are a still a lot of challenges to be resolved. It is evident that the evolution of technology will play a major role in advanced sensing, as the evolution of hardware required for sensing applications will certainly be driven by these technological advances. Even though there are pilot projects for smart cities, there are various challenges. These challenges require a holistic approach for solving, which will involve multi-disciplinary collaborations. or instance, standardization efforts should consider all involved parties, such as municipalities, utilities and other services providers so that unified solutions in terms of sensing and communication infrastructures are put in place. It will be inefficient to have separate infrastructures (in terms of sensing platforms), but it will also be challenging to unify these services under a single infrastructure (i.e., have the same network on the water distribution system as well as the electricity system). Furthermore, non-technical challenges regarding social issues, like education, also need to be considered. In the context of smart city, it is expected that people will have a certain level of skill to understand these systems and be able to use them. For instance, the innovative

solution brought about by advances in sensing technologies, such as improved demand prediction and smart metering, result in a more efficient electricity distribution system, where the customer also plays a role, by adhering to incentive programs. But to what extent does the customer want to be really involved? Some individuals might not even take advantage of such services. These factors should be taken into consideration before services are implemented. Although there are already existing systems and initiatives for smart cities, the infrastructure to implement a fully ubiquitous city will be costly. Furthermore, the cost of restructuring existing cities to fit the fully ubiquitous city model will incur much higher costs. The conceptual idea mentioned in this paper will serve as a model for fully ubiquitous cities to be implemented in future, and will provide insights into additional challenges in the realization of smart cities. Still, there are numerous challenges to be solved before fully ubiquitous cities become a reality.

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