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Enabling Smart Cities with Smart Computing Technologies: Traits, Objectives, Confrontations & Resolutions

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Abstract *—Urban areas are getting more and more congested due to people's migration, natural population growth, environmental changes, and local and national policies. With the rise in urban populations, city governments are required to manage an escalating number of technical, social, physical, and organizational issues arising from complex congregations of people in spatially limited areas. Due to these factors, a wide range of problems have been tackled by exploiting IoT and Future Internet (FI) and Smart and Advanced Computing Technologies(ACT) and their use in the Smart City concept has matured significantly. The concept of Smart City (SC) as a mean of enhancing the quality of life of citizens has gained increasing importance in policy maker's agendas. This paper is an endeavor to convey an overview of traits, objectives, challenges and resolutions of that can be review and addressed in concern with the Information Technology (IT) role in development of smart cities.*

Keywords ***—Smart City, IT, Future Internet (FI), IoT, Advanced Computing Technologies (ACT)***

I. INTRODUCTION

Over half of the world's population lived in urban areas in 2010, and this figure is expected to increase to three quarters by 2050 as depicted in Figure 1. So, cities need to be smart, if only to survive as platforms that enable economic, social and environmental wellbeing [4]. Smart City [1], [2], [5] is the one that uses information and communications technologies to make the city services and monitoring more aware, interactive and efficient.

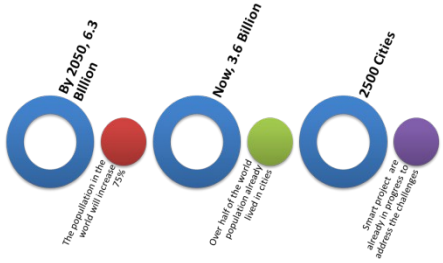

Fig. 1 The Bird Eye View to Dilemma

Smartness of a city is driven and enabled technologically by the emergent Internet of Things (IoT) [4], [5], [8] a radical evolution of the current Internet into a ubiquitous net of interrelated objects that not only harvests information from the environments (sensing) and interacts with the physical world, but also uses existing Internet standards to provide services for information transfer, analytics, and applications. [3],[4],[5],[10], [11]

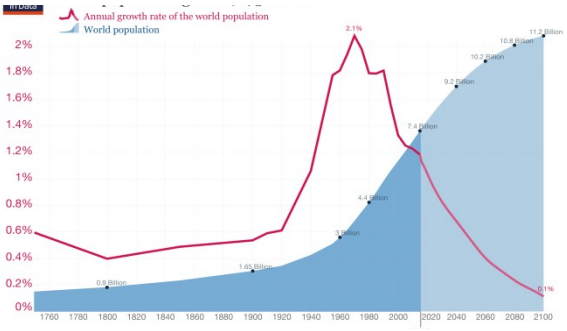

Fig. 2 Rise of world Population since 1760

The most notable reason is the population growth and the urbanization trend. According to the United Nations, the urban populations will grow by an estimated 2.3 billion over the next 40 years, while as much as 70% of the world's population will live in cities by 2050[3],[11].

The paper is organized as follows: first, we review that how need of smart city comes in picture followed by the motivation behind this topic. After which, characteristics of Computing Technologies has defined assured visions and objectives of Smart Cities (defined by the Ministry of Urban Development, Government of India). After that, the challenges will be reveled later on solutions with technology followed by we reach to conclusion.

II. MOTIVATION FOR REASEACH

The city, as a government part, is rising progressively larger, more complex and more important as the population ranks of urban areas

swell with ever increasing speed. With the rapid increase of the urban Population worldwide, cities face a variety of risks, concerns, and problems; for example, physical risks such as polluted air, global warming, transportation challenges, traffic congestions, and economic risks such as unemployment [1],[4],[7],[10],[12].

Because of these influences, a widespread variety of hitches have been tackled by exploiting IoT, Future Internet (FI) and Smart ,advanced Computing Technologies and their use in the Smart City concept has matured significantly.

III.LITERATURE REVIEW

Various attempts have been made to academically define and conceptually describe a "smart city". Giffinger et al[13]. Giffinger et al [13] definition considers smart as performing in a forward-looking way. The integration of those data into an enterprise computing platform and the communication of such information among the various city services. Intelligence refers to the inclusion of complex analytics, modelling, optimization, and visualization in the operational business processes to make better operational decisions. Washburn et al [15].

TABLE 1
DEFINITIONS OF SMART CITY

Smart City Definitions from Literature Review
A city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent and aware citizens.
A city that monitors and integrates conditions of all of its critical infrastructures, including roads, bridges, tunnels, rails, 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.
A city connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city
A city striving to make itself "smarter" (more efficient, sustainable, equitable, and livable)
A city combining ICT and Web 2.0 technology with other organizational, design and planning efforts to dematerialize and speed up bureaucratic processes and help to identify new, innovative solutions to city management complexity, in order to improve sustainability and livability.
The use of Smart Computing technologies to make the critical infrastructure components and services of a city—which include city administration, education, healthcare, public safety, real estate, transportation, and utilities—more intelligent, interconnected, and efficient

IV. CHALLENGES IN SMART CITY DEVELOPMENT

Having acknowledged that cities are the locomotives of growth and are representation a million people every minute from rural areas, the Government has introduced the 'Smart City Challenge'[1], [4], [5], giving over the responsibility of deliberate urbanization to the states.

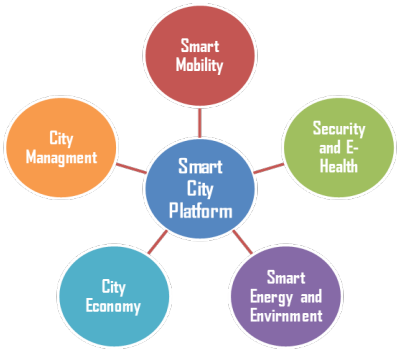

Fig. 3 Smart City Platform Components

Figure 3 indicates the smart city platform concept which has various components like city management, smart mobility, Security and E-Health, City Economy with Smart Energy and Environment [1],[3],[4],[8],[9],[11]. The Challenges in Smart City Development is categorized in following main categories as shown in Figure 4:

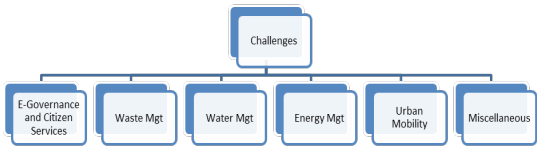

Fig. 4 Chief Smart City Challenges

1. *E-Governance and Civilian Amenities*
2. *Waste Management*
3. *Water Management*
4. *Energy Management*
5. *Metropolitan Mobility*
6. *Miscellaneous Challenges*

The following section will describe them in more detailed way:

1. ***E-Governance and Citizen Services***

It includes problems like public information, grievance readdressed, crime monitoring, Employment tracking, etc.

2. Waste Management

Solid waste management is a dare for the cities experts due to the increasing waste, the burden

posed on the community economical as a result of the high costs related to its management

3. Water Management

In Water Resource Management, the world must understand to prevent future shortages of safe drinking water. The use of advanced technology will enhance available water resources.

4. Energy Management

The main purpose of the Intelligent *Energy Management Challenge* is to find solutions that manage the electricity infrastructure of a city.

5. Urban Mobility

It includes challenges like parking problem, pollution due, Faster and safer traveling choices etc. To address this, problem technology must be applied.

6. Miscellaneous

It includes the challenges like Education, Health Care Services, Medical Service, Skill Development, etc.

V. INSOLENT RESOLUTIONS FOR CHALLENGES

So, Smart cities need healthy and strong technologies that [2],[5],[6],[12]:

- Facilitate heterogeneous ICT-systems by different vendors to work together
- Facilitate instrumentation through the use of multiple types of device for sensing, capturing, storing, and exploiting the use of data from multiple sources, fixed as well as mobile;
- Allow for data to be presented in a variety of formats, dependent on the context and the person or technical system needing it, allowing it to be analyzed, visualized, accessed, and acted upon more easily, thus making it much more useful.

The Solutions under various domains is described below:

1. E-Governance and Civilian Amenities

Similarly, the use of digital content and collaboration technologies can improve the quality of education, at more convenience, at a lower cost. The technology can be applied to implement Systems for: [1], [4], [5], [7]:

1. Centralized Community Information System
2. Open Data Source
3. Smart Working
4. Big Data and Data Mining Based Systems to Stockpile and Investigate Community Data
5. Electronic Goods Delivery
6. Citizens Information
7. Connecting Retailers
8. Digital Signage
9. E-Turisom
10. Video Surveillance and Crime Monitoring

2. Waste Management

As The Smart Computing Technology can be applied to implement Systems for [1], [3], [7], [8]:

1. Systems to convert waste to Energy and fuel
2. Devices to convert Waste to compost
3. Waste water Processing plants
4. Recycling and Reduction of Waste

3. Water Management

Water management is the management of water resources under set rules and guidelines. Water, once a copious natural resource, is becoming a more treasured commodity due to droughts and misuse. In this, following will be Smart Systems [1], [5], [7]:

1. Smart Water Meter
2. Water Management
3. Power, Control and Effective Distribution Systems
4. Leakage Identification and Preventive Maintenance
5. Water Quality Monitoring
6. Water Filtration Systems

4. Energy Management

The energy management technologies examine the operation, maintenance and evaluation of energy systems, including alternative and renewable energy, to improve efficiency and cost-effectiveness.

It includes Systems for:

1. Smart Energy Meter and Management
2. Smart Grid Management and Flexible Distribution
3. Gas Distribution and Management
4. Renewable Energy Sources Integration
5. Using Renewable Sources of Energy
6. Smart Solar Systems
7. Smart Urban Lighting
8. Energy Efficient Systems and Green Buildings

5. Urban Mobility

By supplementary persons existing in the city, police, fire, and other public security personnel essential to react more rapidly to crisis circumstances. It includes various smart solutions like:

1. Smart Parking
2. Intelligent Traffic Management Systems
3. Automated Toll Collection Systems
4. EV Infrastructure with charging facilities and Supervision Services
5. Smart Fleet Management
6. Integrated Mobility with Public Trains and Traveler Information
7. Community Biking and Car Sharing
8. Smart and Faster Transport Systems

VI. CONCLUSION

This study paper canvassed the extremely dynamic and substantial domain of Smart city Development. In this paper we confronted, the basics of Smart City, its need, IT infrastructure to attain various challenges of Smart City Development with various solutions. The important portion of paper gives the various challenges in more detailed way followed by Smart solutions to track challenges in urban area development.

Too it defines that The Role of Smart Computing Technology is mainstay for Smart City Development without which it is unbearable. The paper clearly demonstrates the role of IT in the numerous major domains of Smart City Development. If all described solutions are implemented by cities, then they will become real smart cities. The Smart City Development is one of the spectacular and challenging field today's date and no doubts that, hereafter it will play vital primal in many areas.

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