



INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

THE ARCHITECTURAL OVERVIEW OF SMART-GOVERNMENT AND CHALLENGES OF IOT BASED SMART-GOVERNMENT: A SURVEY

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Abstract

Smart governments are known as extensions of e-governments both built on the Internet of Things (IoT). In this paper, we classify smart governments into two types of new generation and extended smart-government. A smart government basically combines the concept of smart cities and e-government. This paper consists of a framework for smart government implementation and also discuss the major challenges in its implementation. The new tools of e-government have begun to address and diffuse the weakness of government service delivery in the 21st century. Most of the countries like USA, India and Kuwait in last few use the e-government service and are also facing challenges in development of smart-government based on IoT. Over the last few generations, the concept “e-government” has been enabling various governments to serve the public sectors over the use of the Internet. It also allows governments to capture process and report on data efficiently and to make improvement on their decision making. However, the advancements that are made in smart technologies, better informed and connected citizens, and global connected economies have created more opportunities, forcing governments to rethink their role in today’s economy. The governments are beginning to take the concept of e-government to a new higher level by realising the power of data they hold to improve the government services, to enable an integrated, seamless service experience, to engage with citizens, develop policies and implement solutions for well-being of the community and transforming themselves into ‘smart government’. The emergence of social media, mobile applications, big data analytics and mash up technologies is empowering citizens to connect with government in new and different way.

Index Terms: *Internet of Things (IoT), Internet of Everything (IoE), Smart Cities, e-Government, Government 2.0, Smart Government etc.*

1. Introduction

Different countries across the world are trying to develop smart cities. And have defined different parameters on which smart cities need to be developed. Internet of Things (IoT) has revolutionized the 21st century through its applications in smart cities [1].

1.1 What is IoT

The Internet of Things is the network of physical devices, vehicles, home appliances, and other items that are embedded with electronics, software, sensors, actuators, and connections which enables these things to connect and exchange data over network or connections, creating opportunities for more direct integration of the physical world into computer-based systems,

this results in efficiency improvements, economic benefits, and reduced human exertions [5].

The number of IoT devices has been increasing 31% year-over-year to 8.4 billion in 2017 and it is estimated that there will be 30 billion devices by the year 2020. The global market value of IoT is projected to be reach up to \$7.1 trillion by 2020.

IoT involves extending internet connectivity beyond the standard devices, such as desktops, laptops, smartphones and tablets, to any range of traditionally *dumb* or non-internet-enabled physical devices and everyday objects that we use. Embedded with technology and connections, these devices can communicate and interact over the internet, and they can be remotely monitored and controlled very smartly. The market

nowadays for IoT is geared towards smart cities and governments with an estimated 3.3 billion connected smart things in 2018 [6]. Smart cities basically involves establishing sustainable technological processes for managing cities from utility control, electricity, housing, to transportation. The ultimate goal is to provide a safer, better quality of life while reducing costs. Smart city usage of IoT is expected to climb to 9.7 billion by 2020, in comparison to its 1.1 billion investments in 2015.

1.2 E-government

The term “e-government” is coined by the World Bank as information technologies that have the ability to convert relations with citizens, business, and other arms of government, while “governance” as the manner in which power is practised in the management of the country’s economic and social resources for development. E-government assessment and good governance assessment has been performed regularly in Indonesia [2].

1.3 Smart Government

Smart government is thought to be an extension of e-government that applies information, communication, and operational technologies to all operational areas across many domains, process areas, and jurisdictions to produce sustainable public value. The major goals are to streamline communication and advance lives. The use of newest and innovative policies, business models, and various technologies to address the financial, environmental, and service challenges faced by public sector organizations. The concept of Smart Government relies on consolidated information systems and communication held over networks.

Smart-governments are thought to be the next generation of e-governments. Despite its infancy, smart-government initiatives have been made in Dubai, Australia, Singapore and Moldova with promising results [4]. These governments involve innovative operations, communications and technological infrastructures across multiple domains to provide sustainability and serve the needs of the public sectors. By realizing the numerous benefits, governments across the world have started allocating budgets worth billions towards moving from e-government to smart-government [4].

In this paper we try to explain that smart governments are not a direct extension of e-government and propose a state-of-the-art framework for smart governments that illustrate the various players, relationships, processes used and challenges.

1.4 Overview of Smart-Government

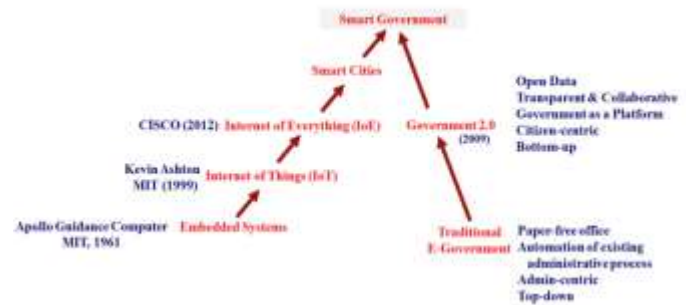


Figure 1: Smart-government

The evolution of technology towards smart government is shown in Figure 1. Since the birth of embedded system at MIT the evolution of technology has resulted in all smart cities that are all built on IoT enabled networks[6].

Traditional e-governments are considered the automation of administrative processes towards paper-free offices, data maintenance, information retrieval, inter-departmental communication, and work-flow automation. It is normally closed, non-transparent, and admin-centric. Government 2.0 on the other hand provides the public with open and transparent data (right for information), is praised for being community-engaged, decentralized or federated, and citizen-centric.

2. Literature Review

Md. Mahmud Hossain[8] discussed about the Internet of Things (IoT) devices that have become popular in diverse domains such as e-Health, e-Home, e-Commerce, and e-Trafficking, etc. With increased deployment of IoT devices in the real world, they can be, and in some cases, already are subject to malicious attacks may be dangerous virus, to compromise the security and privacy of various IoT devices. While a number of researchers have been exploring such security challenges and open problems faced in IoT, there is an unfortunate lack of a systematic study of the security challenges in the IoT environment. This paper aimed at bridging this gap by conducting a thorough analysis of IoT security challenges and problems, and presented a detailed analysis of IoT attack surfaces, threat models, security issues, requirements, forensics, and challenges. A set of open problems is also provided in IoT security and privacy to guide the attention of worldwide researchers into solving the most critical problems.

Dr. S. Prem Kumar[10] discussed about one of the trending technologies i.e. Internet of things (IoT) which can be best utilized in various e-Governance activities. The governance by government is done through e-Governance, m-Governance and now taking a new shape of incorporating IoT in e-Governance. The IoT is gearing up with the facility of communication among the objects (Things) which is generating vital data. This data can be utilized in e-Governance activities for societal benefits. The investigation with a case study on agriculture of Rayalaseema rural areas of Andhra Pradesh, India projected a positive result in turns of

economy and comfort. This paper focuses on the IoT services to e-Governance, particularly in the field of agriculture for better productivity and policy making in operational, strategic and tactical levels. It facilitates rapid communication of data among various departments and establishes alliance among divisions of organizations which in turn enhances the country's economy and leads to prosperity.

Subho Shankar Basu[9] discussed about a mash up of IoT services that extends the reach of the current Internet to potentially resource constrained "Things", constituting what is being referred to as the Internet of Things (IoT). IoT is finding applications in various fields like Smart Cities, Smart Grids, Smart Transportation, e-health and e-governance. The major difficulties of developing IoT solutions arise from the diversity right from device capability. The world is rapidly getting connected. In common everyday things are providing and consuming software services exposed by other various things and service providers.

3. Smart-Government Framework

With the wealth of research available on smart cities, a need for suitable smart-government frameworks is becoming more evident. Based on previous works we present an innovative framework for IoT-based smart-government as shown in Figure 1. The framework shows the actors and activities involved in implementations using a two-layer paradigm.

3.1 Inner-layer phases of Smart-Government

Landscaping is the first stage in preparation for smart-government implementation and usually amounts to one-third of the whole project. Smart-landscaping deals with the creating brand new underlying utility networks like electricity and water, to include IoT systems. Smart-networks involve the upgrade to 5G networks and the establishment of a four-layer lattice: sensors, networks, platform and applications [11]. This core element of smart-government is the IoT foundation and most susceptible to security attacks. Smart-process is the government administrative process built on top of smart-networks. One of the important decisions made before system-process implementation is whether the target smart government is an extension of existing e-government or settle with it being a new generation of e-government.

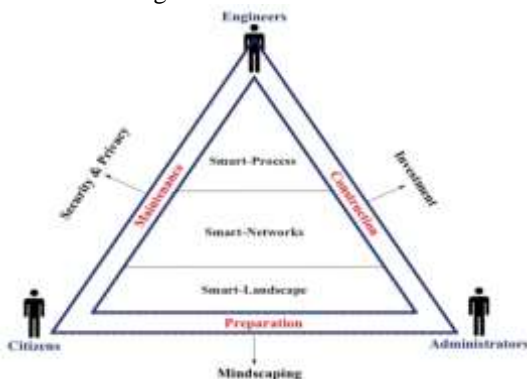


Figure 2: Framework of smart government

3.2 Outer-layer phases of Smart-Government

The first outer-layer phases is preparation which includes initiation, mindset, analysis, concept, priorities, planning, budgeting and design [12]. It starts with deciding whether the smart government being implemented is flat or hierarchical, open or closed, centralized or decentralized [12]. The next step involves changing the mindset of citizens and administrators to accept smart-government. This kind of preparation is carried out by papers, brain-storm meetings, workshops, and training. Administrators play a role in convincing citizens to accept the upcoming changes and citizens have a role to press on administrators to implement the needed changes.

The construction phase begins with smart landscape, smart-networks and lastly the development of smart-process. This is called the implementation phase of smart-government. During the maintenance phase, the infrastructure is repeatedly monitored and managed.

4. Challenges in implementing IoT based Smart-Government

Amongst the charms of Internet of Things (IoT), is its ability to transform e-governments to smart governments, and assist in making governments more transparent and responsive to peoples' needs. This task comes with many challenges that delay the progress of smart-government implementation. Fernandez-Anez et al. proposed a list of 27 challenges across multiple dimensions relevant to implementing smart-cities such as: Mindscaping, Construction and Maintenance [12]. In this section we discuss three IoT-based smart governments challenges of primary concern due to their contribution to overall implementation success or failure: Mindscaping, Investment and Security and Privacy. These challenges accentuate the outer-layer phase of the smart-government framework proposed earlier in Figure 2.

4.1 Mindscaping

Asking a government to adopt a new infrastructure is not easy. The first step to migration from e-government to smart-government is eliciting the approval of the government and the people. We define Mindscaping as the process of convincing an entity to accept a change. Since smart-governments are open, transparent, collaborative, community engaged, and citizen-centric in nature, convincing the people is a minor concern. The major concern is however changing the mindset of the government. There are many governments that remain hierarchical and centralized. In the Middle East for example, deploying a smart-government would be highly desired by the people for a sophisticated life style, but this would require opening tightly closed and rigid administrative systems. The Mindscaping process involved here is the most prominent challenge.

4.2 Investment

In recent years, more and more governments have moved towards e-governance despite the unpredictability of the world economy. To be able to progress from e-government to smart-government existing technological resources need to be upgraded to make way for up-to-date IoT systems. Telecommunication networks are a substantial part of any government. These include porting all existing networks to 5G networks, latest sensors, sizable storage to deal with Big Data, power supplies and much more.

4.3 Security and Privacy

One of the biggest challenges in smart-government implementations is security and privacy. Large IoT networks in smart-governments are at grave risk of security attacks. In October 2016 IoT devices such as digital cameras and DVR players controlled by multiple Mirai botnets were responsible for large, malicious, distributed denial of service (DDoS) attacks on Oracle Dyn systems. This was the largest attack of its kind requiring multiple hours of mitigation efforts until all attacks subsided. An attack of this magnitude if launched effectively could immobilize a government within a few minutes causing harm to the country as a whole.

Overcoming privacy vulnerabilities and existing challenges posed by IoT are necessary for safe implementation of smart-governments. Overall corporate and individuals consumers of IoT devices alike should be tech savvy and evaluate the devices often for vulnerabilities. It is also imperative that regulations involving IoT are set by Internet Service Providers.

5. Open Data: Social and Economic Benefits

Tim Berners-Lee also known as the ‘father of the Internet’ initialised the notion of sharing and distribution of data to empower the general public sectors in a form ‘that allows for the direct manipulation for various analysis, mappings, visualisation or other initiatives taken’ [13]. There are various important developments underway by UK, US and Australian governments to release and publish database sets to the general public by online data portals designed for dedicated purpose. These governments have realised the social and economic benefits this may have on their policies and economies. The emergence of open technologies such as XML, JSON and Geo JSON has fuelled this trend of ‘open, smart and digital government’ which empowers general public to gain insights, to collaborate services and to some extent know their landscape (smart cities initiatives). Governments have been leveraging the benefit provided by the development of mobile apps by entrepreneurs, created from the data supplied by governments. Customers are convinced to pay for useful applications that are service oriented and have a positive impact on their daily lives. This, in return, provides social advantages to the community and save major government resources in investments in major service industries. This coproduction trend will define or derive the future of government services in health, education, transportations, etc. In South Australia, an ‘open data

declaration’ was signed up that promises the government to proactively release databases and is seen as one of the important election issues. There are different political impacts as this can be considered as governments trying to be liberal, and allowing the public to raise questions that would not have been possible in the past decades. The public becomes better aware about whether the government is performing and conforming to highest ethical standards committed.

At present, governments across all over the world are struggling with a framework to measure and understand the social and economic influences of open data. ‘The choice between either giving access to data inexpensively and widely, or restricting access and managing data as a source of revenue is widely discussed amongst the international government communities’. ‘The direct influence of Open Data on the EU27 economy alone itself was estimated at worth €32 Billion in 2010, with an estimated annual increase rate of 7 %’.

6. Developing Smart Government Through Open Data

Smart government is ‘the implementation of a set of business processes and underneath information technology capabilities that enable information to flow seamlessly across government agencies and programs to become instinctive in providing high quality public services across all government programs and activity areas’ [14]. Open data is the major key in the transformation from e-government to smart government.

Open data hubs generally provide access to database in two ways: stored or may be linked. Some datasets are stored on the data portal, whereas some datasets are linked to various government agency sites. Normally, it is up to the government agencies to identify and decide which datasets should be published or should not be published, as they are the custodians of the data. The challenge for open data Web portals such as South Australia’s data.sa.gov.au is to make sure that the increase in the numbers of dataset continues, along with the real-time linked database sets. Another challenge is to empower public to be able to combine datasets seamlessly to create unique and antique insights.

Across the world, governments are faced with a cultural challenge to implement their open data and open government initiatives. The restricted culture within government, which is caused by a general fear of the disclosure of government failures and any resultant democratic reason, is the biggest challenge for transforming into an open government or smart government. To overcome this major barrier, successful governments are taking measured actions in the following domains:

- Community Engagement and Coproduction
- Financial Investment
- Automation
- Collaboration
- Governance

7. Smart Government in Conventional Sense

Regarding the continuous development of smart objects and intelligent networks, it seems reasonable that “smart” is also used in combination with "government" to describe the next level of "digital public management modernization". In 2009, the Emirate of Dubai created the "Dubai Smart Government Department" (<http://www.dsg.gov.ae>), with responsibilities for the full range of government information management and electronic government services. Already since the year 2000, there have been experiments in Dubai in the smart government project with sustainable smart technologies for the urban environment, which should play a leading role in many public construction works. Meanwhile, the e-government activities in the Emirate were reoriented towards smart government. In 2014, the market research firm Gartner describes "smart government" as the integration of information, communication and operational technologies to exercise the planning and management of operations across multiple domains, process areas and jurisdictions to generate sustainable public value [15]. It places the Internet of Things among the top ten of the most relevant technology trends. However, much of the debate about smart governments neglects the aspects of smart objects and CPS. For example, the market research and consulting firm International Data Corporation (IDC) defines "smart government" as "the implementation of a set of business processes and underlying information technology capabilities that enable information to go seamlessly around government agencies and programs to become intuitive in providing high quality citizen services across all government programs and activity sectors" [15]. The associated "smart government maturity model" [15] rather deals with e-government and open government. It is important to accentuate that smart government is not merely a new term to describe e-government and open government. It is also not meant to indicate "clever and shrewd government action", that means adapted to the situation rather than intelligent, as the former US President Bill Clinton formulates in his 2011 published book "Back to Work: Why We Need Smart Government for a Strong Economy". While using smart objects and CPS can certainly lead to better government decision-making and public policy, making better decisions does not qualify a government to be smart. A smart government or a smart state uses the capabilities of smart, networked objects to make smart decisions.

8. Strengths and Opportunities of Smart Government

Indisputably, the Internet allowed that internet protocol based e-government solutions have spread. Smart Government solutions, being based on the same protocol, can integrate existing solutions. State, government and administration neither can nor want to refuse the functional possibilities offered by the Internet of Systems, the Internet of People (social media), the Internet of Data, the Internet of Things, and the Internet of Services. This leads to an intensification of the networking of systems, people, data, objects and services. States will rather see it as a strength if they develop in the context of smart government their own visions for "smart agencies", "smart politics", "smart civil officers", and "smart public" to steer society, economy and administration through these differences successfully. Such visions provide

orientation and room for debates, even about ethical boundaries, ideas, objectives, implementation strategies and concrete actions. This possibility for design has to be used consequently. The greatest opportunity lies indeed in the potential of smart government to trigger further innovations. Not only existing smart objects could be used for the performance of public tasks. Entirely new smart things and services, particularly cyber physical systems, could be designed for the public sector, which offer public services more efficiently and to some extent even more effective. Administration, science and business need to be equally part of this development, combining engineering and public management knowledge. After all, it is about the design of smart objects, processes and services, their networking and smart control in their respective environment. Of course, politically predefined goals have to be considered such as the rule of law, increased efficiency, effectiveness and individualized services, reduced workload for public employees, cost reductions as well as improved control over tasks and expenditure. Citizens and enterprises can thus be provided with an improved range of public services, which should be characterized by a further acceleration, lower fees, individuality and reliability. The assistive characteristics of many smart government systems also help to reduce the administrative staff's workload. However, these opportunities must be recognized and realized[3].

9. CONCLUSION

Smart cities enable increased intelligence of security, transport, and utility, whilst smart governments aim to converge numerous cities and systems to offer a single layer communication channel that result in an open, transparent and citizen-oriented entity. In this paper we have introduced a new categorization of smart government. The proposed smart-government framework emphasizes the challenges facing governments prior.

Deep study indicates that open data can be instrumental in the transformation to a smart government. The traditional closed culture of governments comes in the way of transforming themselves into a more transparent and an open government. Open data hubs provide opportunities to the wider community to self-serve, and to personalise their experience in accessing government services. The benefits are significantly beyond just social and economic benefits. Various jurisdictions have been made significant progress in this space including the UK, the USA and Australia. Steps have been taken to eliminate self-imposed barriers, and to transform itself into smart government. These include community engagement and coproduction, funding, automation and governance.

REFERENCES

- [1]. AlEnezi, Zainab AlMeraj, Paul Manuel (Challenges of IoT based Smart-government Development) 2018 IEEE Green Technologies Conference
- [2]. Ade Hodijah (Analysing Enterprise Architecture Model For Service Based e-Government Towards Good

- Governance) 2017 International Conference on Information Technology Systems and Innovation
- [3]. Jörn von Lucke (Smart Government – The Potential of Intelligent Networking in Government and Public Administration) International Conference for E-Democracy and Open Government.
- [4]. A. Harsh and N. Ichalkaranje. “Transforming e-Government to Smart Government: A South Australian Perspective, L.C. Jain et al. (eds.), Intelligent Computing, Communication and Devices, Advances in Intelligent Systems and Computing ”, Springer India 2015.
- [5]. https://en.wikipedia.org/wiki/Internet_of_things
- [6]. R Jain. “Internet of Things and Smart Cities: Smart Cities: Challenges and Issues Challenges and Issues, 2nd IEEE International Workshop on Sensors and Smart Cities (SSC2016)”. St. Louis,. MO. May 18, 2016.
- [7]. <https://www.igi-global.com/dictionary/smart-government/45119>
- [8]. Md. Mahmud Hossain, Maziar Fotouhi, Ragib Hasan “Towards an Analysis of Security Issues, Challenges, and Open Problems in the Internet of Things” 2015 IEEE World Congress on Services. Available: <https://ieeexplore.ieee.org/document/7196499/>.
- [9]. Subho Shankar Basu, Somanath Tripathy, Atanu Roy Chowdhury “Design challenges and security issues in the Internet of Things” 2015 IEEE Region 10 Symposium. Available: <https://ieeexplore.ieee.org/document/7166245/>
- [10]. Dr. S. Prem Kumar “Internet of Things for Sophisticated e-Governance: A Special Focus on Agricultural Sector” in International Journal of Trend in Research and Development(IJTRD)201.Available:<http://www.ijtrd.com/papers/IJTRD13402.pdf>
- [11]. Y. Li, Y. Lin and S. Geertman, “The development of smart cities in China, CUPUM 2015”.
- [12]. I Zubizarreta, Al. Seravalli, and S. Arrizabalaga, “Smart City Concept: What It Is and What It Should Be”, Journal of Urban Planning and Development, Volume 142, Issue 1, March 2016.
- [13]. Gurstein’s Community Informatics: open data: empowering the empowered or effective data use for everyone? (online). Available at: <http://gurstein.wordpress.com/2010/09/02/open-data-empowering-the-empowered-or-effective-data-use-for-everyone/> (2014). Accessed: 12 Feb 2014,
- [14]. Rubel, T.: Smart government: creating more effective information and services (online). Available at:
- http://www.govdelivery.com/pdfs/IDC_govt_insights_Thomas_Rubel.pdf (2014). (Accessed: 15 Mar 2014).
- [15]. Gartner Inc.: Gartner Identifies the Top 10 Strategic Technology Trends for Smart Government, Dubai 2014.

