Role of Information Technology-Based Tools in E-governance

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ABSTRACT:
E-Governance refers to information technology (IT)-based applications for various government operations. In the given paper, various IT-based tooling options are explored that can be incorporated as per service requirements. Tooling options that are explored include virtualization, database management systems, mobile systems, cloud computing platforms, web services, state-wide area networks, digital image processing for vehicle recognition, plate detection, and biometric-based solutions. Along with various benefits of using IT-based solutions, there are different fields where e-governance can be implemented. Proposed stages and types of interactions in e-governance are discussed. Challenges in achieving objectives of e-governnance are discussed.

KEYWORDS: E-government, Objectives, Virtualization, Cloud Computing, Mobile Computing, Database Management System, Challenges

INTRODUCTION TO E-GOVERNANCE:
Governance refers to the exercise of public administrative authority in the management of government affairs to facilitate citizens' interests, rights and obligations. E-governance may be understood as the performance of this governance through vairous electronic means for the efficient and transparent processing of information and services to the public and other agencies and for the performance of government administration activities.
E-governance has the ability to change relations not only between citizens and governments but alsoamong them, so the range of e- governance far exceeds that of e-government. E-governance can bring about new forms of citizenship in terms of citizen needs and responsibilities.

MAIN OBJECTIVES OF E- GOVERNANCE:
   I.   To improve good governance in terms of accountability, participation, and transparency.
  II.   Engage, enable, and empower citizens through more effective and efficient government processes.
 III.   To form strong relationships with citizens through advances in communications technologies.
 IV.   Use of IT-based applications to increase citizen participation in government operations.
  V.   Reducing transaction costs of services to make them more accessible to citizens.

DIFFERENT FIELDS WHERE E-GOVERNANCE CAN BE IMPLEMENTED:
I. E-ADMINISTRATION:
This refers to various IT-based applications that can improvement administrative operations in the public sector.
II. E-SERVICES:
This field corresponds to improvements in various services provided by the government to citizens through IT-based applications, such as reducing excessive overhead and costs for various government services.

III. **E-DEMOCRACY:**

This focuses on making citizens more active by encouraging their participation in various government activities through various IT-based applications.

PROPOSED STAGES FOR E-GOVERNANCE:

The platform around which the implementation of e-governance is expected to be established is of course computers as well as various related technologies such as computer system networks involved in communications systems. E-governance can be expected to proceed as follows:

I. **COMPUTERIZATION:**

The initial phase requires the availability of personal computers in all government offices so that different types of software programs required for providing services can be installed on those computers.

II. **NETWORKING:**

Different systems in different government organizations must be properly interconnected to share various information for the smooth flow of data across organizations.

III. **ONLINE PRESENCE:**

This is the most efficient channel for the government to become closer to citizens. Various government departments can have respective websites containing different information such as mission/vision statements, structures of organizations, timely reports, publications, and contacts, among others.

IV. **ONLINE INTERACTIVITY:**

Online presence provides a way for the government to engage in more efficient interactions online with citizens. Various types of documents can be made available online and can be downloaded by citizens anytime, anywhere.

TYPES OF INTERACTIONS IN E-GOVERNANCE:

E-governance can provide many ways not only to restructure government processes but also to facilitate interactions among diverse stakeholders. Different types of interactions include the following:

I. **G2G (GOVERNMENT TO GOVERNMENT):**

This type of interaction is only between government organizations and departments. It can be either horizontal (interaction between different functional departments of a given organization and between different government agencies) or vertical (interaction among national, regional, and local governments.

II. **G2C (GOVERNMENT TO CITIZENS):**

The main purpose of this type of interaction is to make governments more accessible to caitizens through services to citizens that they can better relate to, such as the Internet, fax, telephone, face-to-face interactions, and email.

III. **G2B (GOVERNMENT TO BUSINESS):**

This type of interaction refers to the smooth flow of various business-related processes such as licensing, transactions, permits, revenue collection, tourism, trade, and investment. If such interactions can be facilitated more efficiently by using IT tools, then they can foster environments conducive for business growth.

IV. **G2E (GOVERNMENT TO EMPLOYEES):**

Employees' satisfaction is crucial for the success of e-governance, and therefore interactions between the government and employees should be made efficient through the use of various IT tools. This interaction can be a two-way approach. Here the idea is that a satisfied employee performs better for the government.

VARIOUS TOOLING OPTIONS PROVIDED BY IT-BASED APPLICATIONS:

The e-government framework requires the use of a diverse range of technologies and protocols. Some such factors include networking LAN/WAN protocols, directory services, domain-naming systems, file/hypertext/message transfer protocols, messaging/data integration systems, schema/metadata registries, web-based services, middleware, security systems, authentication systems, character sets, mewsgroup

services, browsers/viewers, short messaging services, open standards, software, and reusability systems. Based on this, the framework can be explained as follows:

1. IT-BASED VRPD (VEHICLE RECOGNITION PLATE DETECTION) FOR E-SURVEILLANCE

This a system through which vehicles can be identified based on the number plate registered with administrative authorities.
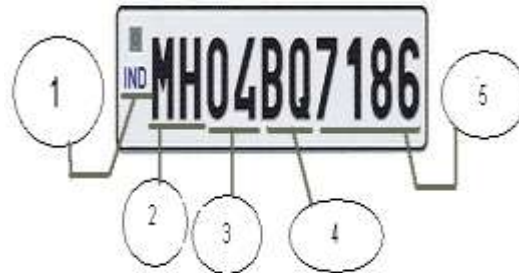
ELEMENTS OF A VEHICLE NUMBER PLATE INCLUDE:

a) Country code,
b) State code,
c) Dist. IT code,
d) Vehicle category,
e) Registration number.

2. BIOMETRIC SOLUTION IN E-GOVERNANCE:

A biometric system is a type of recognition system in which some information from a given user is matched with some predefined information in the system. This authenticates the user and is a useful tool for the government to monitor employees and their tasks for their effective completion. This can be applied to the following:

a) Controlling access to airports,
b) Security issues in banking,
c) Distribution of government services such as welfare disbursement,
d) Unique national IDs,
e) Customs and immigration.

3. VIRTUALIZATION:

This technology involves the running of multiple operating systems on the same platform by virtually partioning available resources in terms of the network interface card, the processing unit, memory, operating systems, applications, desktop computers, data, and paravirtualization. Virtualized systems can be more efficient than non-virtualized ones. Virtualization can be used in the following ways in e-governance:

a) Reduced hardware requirements,
b) Reduced power consumption,
c) Reduced space requirements,
d) Reduced air conditioning requirements,
e) Reduced testing and deployment requirements,
f) More effective server consolidation,
g) Disaster recovery,
h) Improved system reliability,
i) Dynamic load balancing.

4. CLOUD COMPUTING:

Cloud computing is an IT model featuring ubiquitous, convenient, and on-demand network access to a shared pool of IT resources such as networks, servers, storage, applications, and services for efficient management systems and service provider interactions. Cloud computing broadly covers three major service models, including software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS). Cloud computing can provide many benefits for e-governance:

a) Reductions in the cost of application development,
b) Easy extension of cloud-based applications from a few users to many,
c) Reducations hardware requirements under a temporary increase in the number of users,
d) The provision of a more reliable, flexible, and efficient computing experience for the user.

5. STATE-WIDE AREA NETWORK (SWAN):

A state-wide area network (SWAN) is a major component of e-governance. All governments require secure and fast connectivity to state headquarters, district headquarters, and block headquarters. The main purpose of SWAN is to create a closed user group network (CUG) by connecting points of presence (PoPs) to provide data, voice, and video communication. SWAN provides efficient government service delivery mechanisms and performance optimization. To facilitate transactions between government departments, SWAN provides reliable horizontal and vertical connectivity. Here the vertical component consists of a multi-tier architecture framework where the primary tier consists of state/UT headquarters (SHQ), the secondary tier consists of district headquarters (DHQs), and the third tier consists of block headquarters (BHQs). In the horizontal component, government departments are connected to their own PoPs in each tier.

6. STATE DATA CENTER (SDC):

The state data center (SDC) is an important element of the core infrastructure supporting e-governance initiatives by providing services to citizens through greater reliability, serviceability, and availability. These services can be provided through core connectivity infrastructure systems such as SWAN. By minimizing the IT management cost, data management and deployment can be made more efficient. The SDC has many features, including online service delivery, service integration, secure data storage, state intranet portals, central state repository, crisis recovery, information portals, and remote management.

7. COMMON SERVICE CENTER (CSC):

A common service center (CSC) provides information and e-services in rural areas, and its main purpose is to provide e-services to people who lack internet connectivity. A CSC is usually a kiosk consisting of a personal computer, wireless connection, and other necessary equipment. The CSC can provide multimedia content for government and private services such as health care, education, and e-governance. The basic objective of a CSC is to deliver public services through government-to-consumer (G2C) and business-to-consumer (B2C) platforms, provide access to quality education, provide access to information for rural citizens, and provide access to valuable health services. Therefore, basic components of a CSC consist mainly of IT, connectivity, services, business models, and capacity building.

8. DATABASE MANAGEMENT SYSTEM (DBMS):

Because the efficient service facilitation of e-governance includes large amounts of data, data management should be efficient and reliable. Here an organized collection of data is known as a database. An IT-based software database management system is an application for acquiring, storing, and retrieving data. Depending on the type of application to be used in e-governance, different types of database models can be used as follows:

Type of data	Data model	Example
Document databases	Collections of documents containing key-value collection	CouchDB, MongoDB
Graph databases	Nodes and relationships with key-value pairs	AllegroGraph, InfoGrid, Neo4j
Relational databases	A set of relations	VoltDB, Clustrix, MySQL
Object-oriented databases	Objects	Objectivity, Gemstone
Key-value storage	A global collection of KV pairs	Membase, Riak
Big-table clones	Column family (a tabular model in which each row can have an individual configuration of columns)	HBase, Hypertable, Cassandra
Data structure servers	Operations over dictionaries, lists, sets, and string values	Redis
Grid databases	Space-based architecture	GigaSpaces, Coherence

9. MOBILE COMPUTING:

Mobile computing, also known as nomadic computing, makes use of portable devices such as laptop computers and smart phones in conjunction with mobile communications technologies to enable users to access the Internet anytime, anywhere. Various mobile apps can be used for e-governance services through this directly connection with citizens. **Key** benefits of this technology include the following:

a. Location flexibility,
b. Time savings,
c. Enhanced productivity,
d. Easy information searches,
e. Efficient business processes.

10. WEB SERVICES:

Web services refer to client and server applications that communicate through the hypertext transfer protocol (HTTP). As described by the World Wide Web Consortium (W3C), web services provide a standard means for interoperabilty across IT applications on diverse platforms and frameworks. Web services are characterized by their interoperability and extensibility as well as their machine-process-able descriptions through the use of XML. Web services can be combined to facilitate complex operations. Programs providing simple services can interact with one another to deliver sophisticated value-added services. Web services provide many benefits such as application/data integration, versatility, and cost savings for e-governance based on the efficient deployment of various web applications.

11. BAR CODES:

Lines of different widths and sizes represent data that can be read through scanners. Barcodes are used to help index information and can be used in a number of applications by reducing human effort.

12.   SECURITY AND CRYPTOGRAPHY:

To secure e-governance applications from various factors such as spoofing, repudiation, disclosure of e-governance information, and cyber crimes, the government can make use of various algorithms such as symmetric/secret key encryption, asymmetric/public key encryption, and secret key exchange, among others.

13.   CUSTOMER RELATIONSHIP MANAGEMENT (CRM):

IT is designed to allow users more profits. There are several types of CRM, including sales force automation (SFA), marketing, customer service, appointment systems, and social media. One most important function of CRM is customer segmentation. Customers have individual needs, and CRM segments customers into groups based on similar behaviors to identify their characteristics. Adaptive resonance theory belongs to CRM and is a good way to address huge amounts of data and classify customers under CRM. The government can make use of this technology where there are direct interactions with customers. CRM can help manage customers in a more efficient manner.

APPLICATION OF IT-BASED TOOLS IN E-GOVERNANCE:

By making use of the aforementioned IT applications and services, governments can provide the following services to citizens in a secure and reliable manner:

- Online form filling / income tax
- Bill sourcing and payments
- Passport department services
- Birth / death / marriage – registration / certificates
- Pension department
- Community information center

- Permits / licenses
- Distance education
- Transport department services / reservations
- Electricity bill
- Tender management for different department, authority
- Fire department

- Revenue collection
- Land records
- State / central government department wise work
- Local and global information on weather
- Telephone bills
- Municipal tax collection

BENEFIT OF E-GOVERNANCE:
I.   EASE OF ACCESSING INFORMATION AND QOS:

E-governance provides immediate reductions in efforts, time, and money for online services. Complexity of accessing information can be reduced, and services can be made more transparent and efficient. In addition, various forms can be made available for citizens to easily access necessary resources, and activities related to performing tasks can be done more efficiently. By uploading various financial documents on online portals, the government can allow citizens to access various activities and status for greater reliability and transparency.

II.   INCREASED ACCOUNTABILITY AND EFFICIENCY:

The combination of IT with various government processes in addition to re-engineered business processes can simplify government services and tasks, leading to better decision-making capability for the government in analyzing data with IT-based applications, for example. The accountability of the government can increase by streamlining of various processes. To reduce corruption, online portals can be developed using IT-based applications for direct reporting by the informer to anti-corruption departments by keeping the identity anonymous.

III.   INCREASED RANGE OF GOVERNMENT SERVICES:

IT has allowed more government services to be delivered to citizens. With the expansion of internet connectivity, mobile technologies, and other infrastructure systems, the domain of government services has expanded substantially. For example, CCTV systems are applied in various sensitive areas. The provision of vehicle recognition plate detection systems has made the implementation of traffic law more efficient. Mobile apps for various government functions have been deployed by the government to enable closer attention to individual citizens.

CHALLENGES/ISSUES RELATED TO IMPLEMENTATION OF E-GOVERNANCE:
I. ISSUES RELATED TO TECHNOLOGY TRAINING:

ICT-based applications are relatively new for government employees. The rate of adoption of a new technology is likely to vary from a person to a person, and therefore appropriate training focusing on relevant tasks must be deployed for each department for the smooth implementation of e-governance.

II. FUNDING ISSUES:

Although IT-based applications have many benefits, there remain the serious issue of financial cost for the practical implementation of such technologies. Because data and users related to e-governance are diverse, IT-based applications should be reliable, making such resources expensive. Therefore, proper budgets must be allocated for the successful implementation of e-governance.

III. TRUST:

For the implementation of e-governance, there must be appropraite level of trust. From the the user's point of view, users employing online government services must be comfortable and confident in the technology. In addition, the government must be confident about various IT applications being applied to its organizations.

IV. DIGITAL DIVIDE:

The digital divide corresponds to differences in accessing information available to different groups, individuals, and businesses using IT-based e-governance services. Many citizens of lower economic status may not have sufficient access to computer-based services, making them less likely to reap benefits of e-governance. A lack of awareness is another factor arising from the digital divide. This lack of awareness can be addressed by making use of services on mobile devices.

V. PRIVACY AND SECURITY:

Sensitive personal information on citizens must be kept private to prevent unauthorized access. The development of various projects with secret information such as income tax returns, defense data, and medical information can be challenging if there are no effective security standards. In this regard, various encryption techniques should be used to process data to prevent data from being stolen by malicious users.

CONCLUSIONS:

Finally, IT entails many applications for the implementation of e-governance objectives. IT-based applications have many benefits for citizens as well as to governments, including ease of accessing facilities, increased accountability, increased range of government services, and increased service quality. At the same time, there are many challenges in implementing IT-based applications, including heavy costs. E-governance is a resource-intensive intiiative, and therefore governments, particularly those in developing countries with

limited resources, should take into account successes or failures of other governments in e-governance. The use of open-source tools, in-house applications, and various forms of assistance from various stakeholders (including NGOs) may help facilitate the development of IT-based applications for e-governance.

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