



Role of Various Emerging Technologies in E-Governance for Making Digital Transformation

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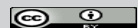
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ABSTRACT

E-Governance has appeared as a revolutionary method for advancing public service delivery, developing administrative effectiveness, and reinforcing democratic participation. The scope and capabilities of E-Governance systems has expanded significantly due to rapid advancements in digital technologies. This paper explores the role of various emerging technologies like Artificial Intelligence (AI), Machine Learning (ML), Big Data Analytics, Blockchain, Internet of Things (IoT), and Cloud Computing in E-Governance. This study investigates the matter that how these technologies promote accuracy, transparency, accountability, and governance that prioritizes citizens with the help of making automation, secure data management, real-time decision-making, and seamless access to public services possible. Artificial Intelligence (AI), Machine Learning (ML) facilitate smart decision-making, automated service delivery, and predictive analysis, minimizing human mistakes and administrative delays. With its decentralized and tamper-proof systems, Blockchain technology assures data integrity and trust, making it necessary for land records, identity management, and public finance tracking. The IoT facilitates sensor based governance in areas like smart cities,

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environmental monitoring, and disaster response. E-Governance can utilize Big Data Analytics to derive significant insights from extensive datasets, helping in the creation of targeted welfare initiatives and policies based on evidence. Cloud Computing provides scalable infrastructure, cost efficiency, promoting interoperability, and remote service accessibility. This paper also highlights issues like cybersecurity risks, data privacy concerns, lack of digital literacy, and infrastructural disparities that may delay effective implementation. With the integrating of emerging technologies into E-Governance can significantly strengthen public administration and foster sustainable development.

Keywords: ICT, E-Governance, Digital Governance, Emerging Technologies, Artificial Intelligence, Blockchain

E-Governance or Electronic Governance refers to the performance of governance functions using information and communication technology (ICT). E-Governance refers to the use of ICT to deliver government services, facilitate information exchange, conduct transactions, and integrate existing services and information portals. Digital Governance indicates to executing governance processes digitally in order to provide digital services. Digital Governance is also referred to as online governance, electronic governance, internet governance, transformational governance, and connected governance. E-Governance refers the application of ICT by governmental or public entities for the purpose of public governance. In this way, E-Governance is primarily transitioning into SMART governance. The goals and aims of E-Governance are as follows:—

- ❖ To provide improved services to the public
- ❖ Promoting transparency and responsibility
- ❖ Strengthening individuals with knowledge
- ❖ Increase efficiency in Government operations like those between Center and State or among different States
- ❖ Enhance engagement with commerce and trade

Various researchers have defined the E-Governance like as follows:—

Prabhu (2004) have defined the E-Governance is that E-Governance is the use of information and communication technologies to achieve desired goals, characterized by SMART governance and a focus on citizens, with ‘e’ as a prefix.

According to Dawes (2008) E-Governance encompasses the application of ICT to facilitate government management, democratic functions, public services, and interactions among civil society, citizens, the private sector, and governmental entities.

As per Öktem *et al.* (2014) E-Governance is the term for governing with citizens using Internet technologies.

REVIEW OF LITERATURE

A number of research articles and studies have been evaluated related to the concept of E-Governance. This article investigates the following literatures:—

Islam, K.M. (2003) in his work has stated the success stories from India relating to revenue governance and land records. However, private entities have performed data entry tasks in an offline setting. Due to insufficient knowledge and work culture, the procedure was slow and prone to errors. To successfully implement development initiatives, accurate and proper land records are needed.

Mittal, P. & Kaur, A. (2013) in their paper have elaborated on the concept of E-Governance, which indicates to the use of ICT for providing public services online. India, as a developing country, has a vital portion of its citizens living below the poverty line, and it also faces high illiteracy rates. The authors stated that numerous Indian citizens are unaware of the advantages of E-Governance. They indicated that there are issues and challenges regarding the implementation of E-Governance activities. The authors emphasize the main issues related to the implementation of E-Governance in India. The problems include the fact that the literacy level is low, many citizens live below the poverty line, and India's e-Readiness Rank is not high. The Global IT Report 2012 stated that the utilization of ICT in India was quite low.

Monga, A. (2008) mentioned that E-Government comprises a vast array of activities like G2G (Government-to-Government), G2C (Government-to-Citizens), and G2B (Government-to-Business). However, there are some general goals like increasing proficiency and authenticity, as well as providing effective services for specific groups. The G2G form is the core of E-Government. Before rolling out electronic transactions with the public and in commerce, government should generate and refresh their internal platforms and processes at local, state, and central levels. Data and services will be exchanged more frequently among different government entities, thereby enhancing interaction across different government spheres. The interaction can be horizontal, involving data exchanges between departments within the same institution, or vertical, including interactions among local, state, and national government organizations. G2C serves as an intermediary between the public and government, offering a wide array of public services. The fundamental objective of E-Governance is to develop citizen involvement and participation in governance. G2B serves as a platform linking governmental and commercial sectors.

Pankan, N. (2017) carried out a research into how well Akshaya e-centres in Kerala perform and how effective they are at addressing issues and challenges related to manual administration. The study has addressed the quality of public service delivery, the advancement of E-Governance in Kerala, and the financial viability of E-Governance projects for Akshaya entrepreneurs. The researcher collected the perspectives of entrepreneurs and beneficiaries to perform the study across three districts in Kerala. The research has concentrated on the role of

Akshaya e-centres in achieving transparency by corruption reduction. The research released indicated that Akshaya e-centres created enough revenue to meet their operational costs. The primary costs associated with the Akshaya initiative were startup costs and operational costs. To enhance the profit margin, the entrepreneur has employed various strategies.

Paul, P.K. *et al.* (2017) in their work emphasized that IT and computer sciences, along with other fields associated to data processing and management, are essential in the realms of medical and health-related disciplines. Allied medical fields such as radiology, robotic surgery, paramedical science, audiology, and medical imaging technologies are situated within these domains, where IT and telecommunication have proven to be invaluable and significant. These digital technologies are useful for in-house functions, promoting other related operations, and advancing education and research. As per the authors, the Government must focus on and nurture the advancement of a health system driven by computing and related technologies.

OBJECTIVES OF THE WORK

This paper titled “*Role of Various Emerging Technologies in E-Governance for making Digital Transformation*” has some basic objectives like as follows: —

- ❖ To be informed about the fundamentals of E-Governance.
- ❖ To understand what E-Governance means.
- ❖ To gain knowledge into the various categories of E-Governance.
- ❖ To learn about the different emerging technologies in E-Governance.
- ❖ To discover how new technologies are applied in E-Governance.
- ❖ To acquire knowledge regarding the different merits and benefits offered by E-Governance
- ❖ To be aware of various issues and challenges related to E-Governance

Methodology of the work

The paper entitled “*Role of Various Emerging Technologies in E-Governance for making Digital Transformation*” is both conceptual and theoretical. The current work is of a descriptive nature. It depends completely on data from secondary sources. The data and information used for analysis come from different sources, including printed articles, journals, government publications, reports, and several official websites of the Government.

E-GOVERNANCE

Information and Communication Technology (ICT) is used by E-Governance to develop government operations and service delivery to citizens, businesses, and other governmental entities. It includes utilizing digital platforms for delivering services, sharing information, and

carrying out transactions to promote governance that is more efficient, accessible, transparent, and accountable, thus improving public administration and citizen involvement.

According to Gupta and Jana (2003) that E-Governance encompasses numerous operations, including employing local languages, designing a public interface that is user-friendly, integrating a back-end database, establishing connections across multiple channels, ensuring secure transactions, related to cyber law infrastructure, participating in policy-making procedures, promoting transparent government operations, and facilitating permission among government organizations to establish open functional styles.

According to Marche and McNiven (2003), E-Governance encompasses the interaction between the public and governments facilitated by technology, situated within the context of electronic discussions on public communication, public policy, and democratic expressions of citizen intent.

Types of E-Governance

E-Governance services can generally be categorized into four types:—

1. **G2G (Government to Government):** Interaction of the G2G kind typically occurs between government entities. Example of this kind of E-Governance services are policy formation, administration etc.
2. **G2C (Government to Citizen):** This type of interaction takes place between the government and its citizens. People can make use of a variety of routine services here (Achanta, M. (2023). Every public group across the country can express their opinions and complaints about public policy whenever they wish and from wherever they are. Instances of this type of services are land record, birth certificate, death certificate etc.
3. **G2B (Government to Business):** The term G2B denotes the relationship between the government and the business sectors, trade, and commerce. Examples of this type of services are Tender, Taxation, etc.
4. **G2E (Government to Employee):** In G2E type, communication usually takes place between the government and the employee. For ICT, their interaction is both rapid and effective. Instances of G2E type services are Pension, income tax, etc. Fig. 1 illustrates four types of E-Governance.

Some Benefits of E-Governance

E-Governance has various benefits and some of them are stated in below:—

Transparency— One main advantage of E-Governance is its transparency. The portals must contain uploads of entire government information. After that, the information can be

accessed easily and at any time by citizen from all locations. The government must know that comprehensive data must be uploaded to the government website.

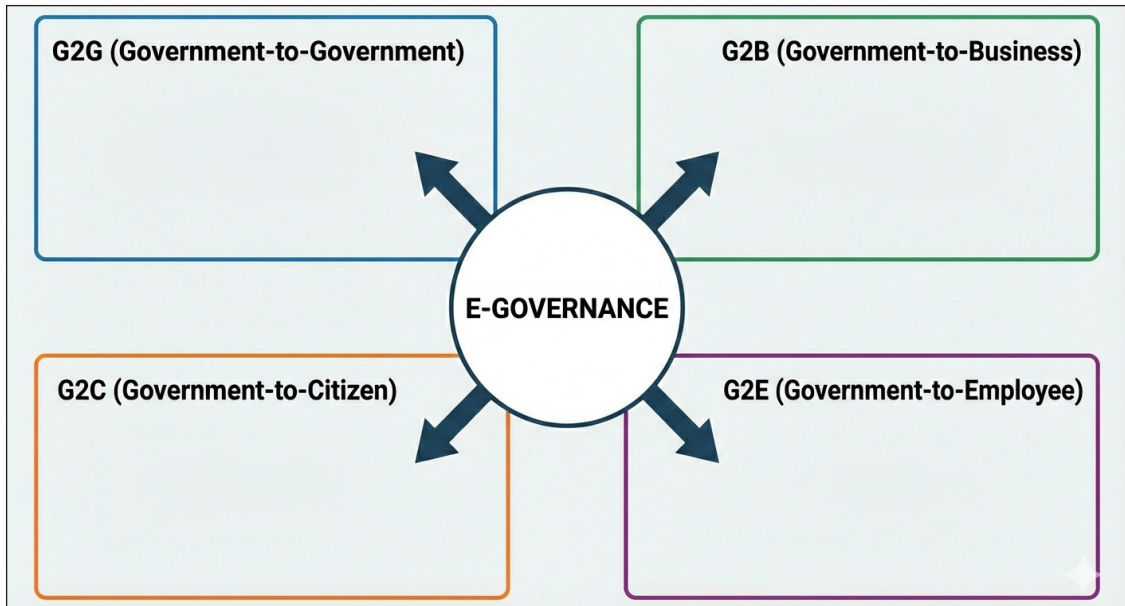


Fig. 1: Types of E-Governance

Accountability— Transparency and accountability are interconnected. While individuals can hold government officials accountable for their activities, the government's activities are subject to examination.

Saving Costs— A huge amount of money is spent by the Government for office stationery buying. Letters, documents, and deeds utilize large-sized stationery. But replacing them with smartphones, computers, and the internet can result in annual cost savings amounting to crores.

Reduced Corruption— Since in E-Governance all the governmental information are open to all and it can accessible from any place, so it helps to reduce corruption largely.

Speed— Nowadays citizens can communicate with others very fast due to advanced digital technologies.

Growth in GDP— Transparency and reduced corruption linked to E-Governance can help in GDP growth. Minimizes bureaucratic red tape and minimizes paperwork in the administrative process; improves planning and collaboration across different levels of government.

Some Issues and Challenges of E-Governance

Some of the issues and challenges of E-Governance are discussed in below:—

Cost of Implementation and Maintenance-The E-Governance implementation faces some challenges for the high starting and running maintenance costs. This is a big problem for developing countries. It needs vital investment in infrastructure, hardware, software, and expert personnel for the effective activities and maintenance of systems (Batra & Kapoor, (2012).

Security Risk and Data Breaches- Due to high dependence on digital platforms, E-Governance systems are susceptible to security threats and data breaches. This results in privacy violations, financial damage, and a decline in public confidence.

Digital Divide and lack of access- As E-Governance systems depend on digital devices and internet connectivity; they can exclude individuals from remote areas or those unable to afford such technologies.

Potential for Misuse of Personal Data- Individuals or groups can misuse stolen or improperly accessed data for various purposes, such as financial fraud, identity theft, or even political influence.

Language Barriers- The drawbacks of E-Governance due to from language barriers encompass reduced accessibility for those who do not speak English, resulting in a digital exclusion gap that leaves many people unable to comprehend or make use of the platforms.

EMERGING TECHNOLOGIES IN E-GOVERNANCE

Emerging Technologies that are used in E-Governance as follows—

1. Artificial Intelligence (AI),
2. Machine Learning (ML),
3. Big Data Analytics,
4. Blockchain,
5. Internet of Things (IoT), and
6. Cloud Computing.

Role of Artificial Intelligence (AI) in E-Governance

Artificial Intelligence (AI) refers to the capability exhibited by machines to perform tasks like to human abilities, such as speech recognition, decision-making, and language translation. AI can automate repetitive tasks, see relationships, identify connections, and generate predictions with a fair degree of accuracy. To effectively use AI technologies, it is necessary to familiarize

oneself with different algorithms before implementation due to the multitude of available options and the rapid emergence of new ones in this evolving field (Al-Besher & Kumar, (2022). Secure methods for exchanging confidential data and information are essential for E-Governance services, which also aims to secure electronic infrastructure (Cloete, F. (2024). AI technology can significantly enhance the effectiveness of E-Government services. E-Governance is vital for delivering government services. By utilizing artificial intelligence (AI) and the Internet of Things (IoT), E-Governance services can be designed to ensure that citizens, even in rural areas, can easily access these services. The Internet serves as the foundation for all E-Governance services. Worldwide initiatives are underway to offer E-Government services to citizens at all levels, from smart cities down to villages. AI enables governments to automate repetitive tasks and reduce manual workload. Smart cities use AI integrated with IoT, sensors, and big data. AI algorithms detect anomalies and help reduce corruption. AI algorithms detect anomalies and help reduce corruption. Governments use AI to strengthen law and order. AI supports farmers through government platforms. AI is used for various purposes like to crop disease detection using images, weather prediction and advisory, Smart irrigation governance, and market price forecasting.

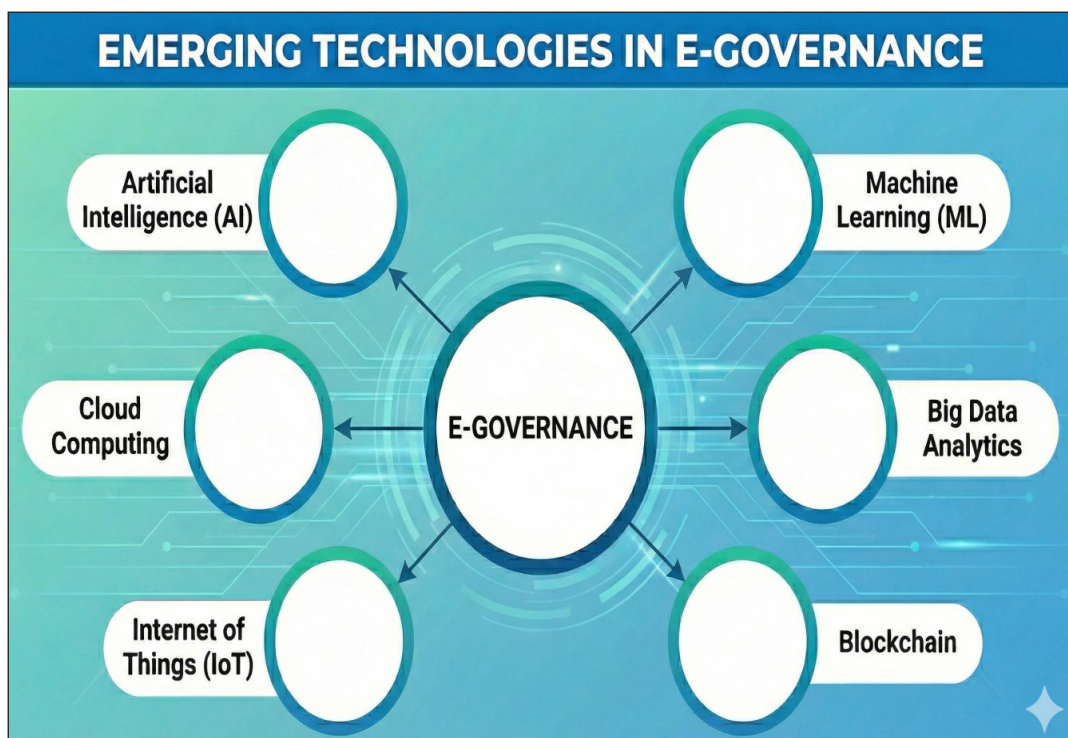


Fig. 2: Emerging Technologies used in E-Governance

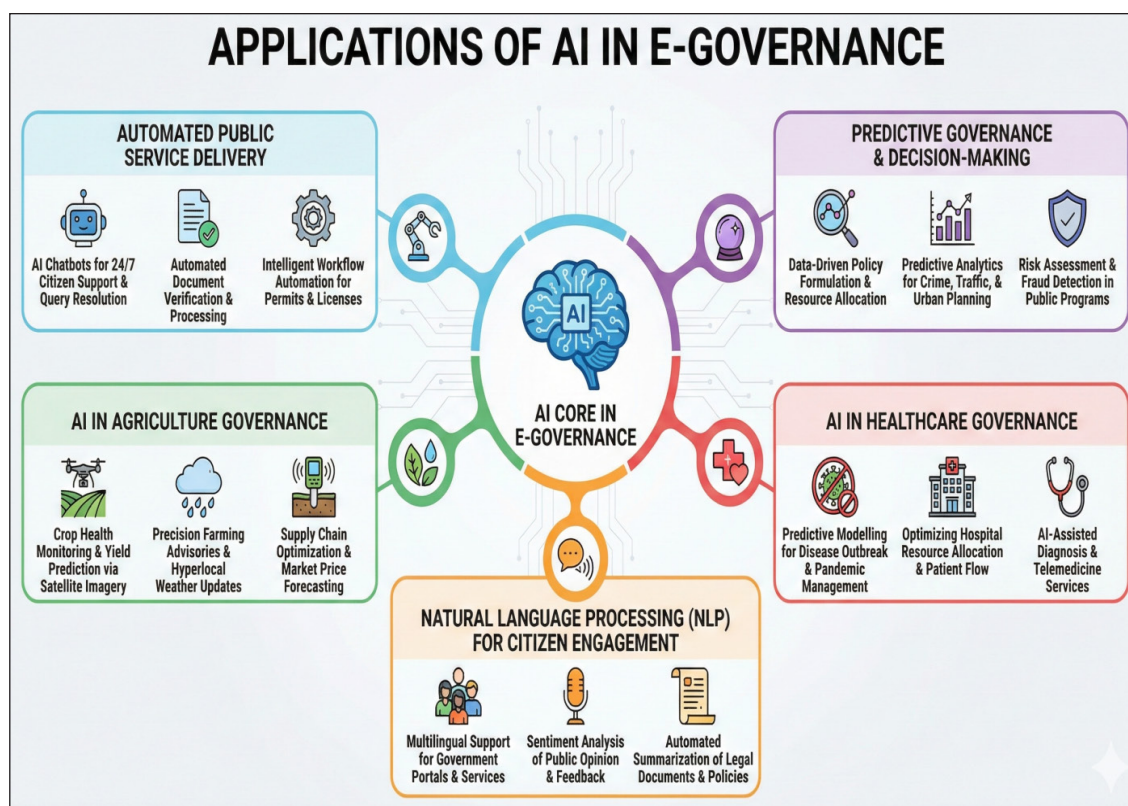


Fig. 3: Applications of AI in E-Governance

Role of Machine Learning (ML) in E-Governance

The role of Machine Learning (ML) in E-Governance is to transition public administration from reactive to proactive that is predicting and preventing problems. Conventional E-Governance digitized paper forms, but ML injects intelligence into those systems. ML uses historical data to detect anomalies, automate complex decisions, and personalize citizen services. Machine Learning (ML) is a core component of artificial intelligence. It plays a transformative role in modern E-Governance systems by enabling automated decision-making, predictive analytics, and advanced service delivery. Machine Learning helps governments to become more efficient, effective, transparent, citizen-centric, and data-driven. Machine Learning algorithms analyze huge datasets to identify patterns and forecast trends. It helps for predicting disease outbreaks, estimating traffic flows and anticipating agricultural production. This helps governments to make informed, and take proactive decisions. Machine Learning enables faster and more accurate processing of public services. It helps for automating document verification. Machine

Learning models detect unusual patterns and anomalies in government transactions. It monitors financial transactions for corruption. This develops accountability and reduces misuse of public funds. ML automates repetitive administrative tasks like route optimization for public services and auto-responding to common man queries (chatbots). This minimizes workload on officials and speeds up service delivery. Governments utilize ML-powered systems to better comprehend citizen behavior and needs. It enables more responsive governance. ML supports intelligent monitoring and preventive security like facial recognition-based identification and disaster early-warning systems. These systems boost national security and emergency response efforts. ML optimizes urban planning and smart city operations. Machine Learning plays a vital role in transforming E-Governance into a smart, efficient, effective, transparent, and citizen-centric system. Governments can significantly enhance operational efficiency and improve public service outcomes by using ML algorithms for prediction, automation, fraud detection, and personalized services.

Role of Big Data Analytics in E-Governance

Big data refers to a collection of data with a high volume. In general, Big Data refers to a collection of data that is characterized by its huge volume and complexity. Big data and its application are growing around the world in many areas like E-Governance, Administration, Education & Training, Transportation & Tourism, Healthcare & Medicine etc. (Agnihotri & Sharma, 2015); Broome, 2015); Brous and Janssen, 2015). Big data can be classified into three types like Structured, Unstructured and Semi-Structured (Al-Besher & Kumar, (2022).

Big data help to advance customer service, better operational efficiency and Better Decision Making processes. Big data is used in E-Governance area with the concept of megacity, smart city. Healthcare organizations, from individual physician offices and multi-provider groups to extensive hospital networks, can effectively and efficiently utilize big data (Islam, 2003). In the initial phases of the implementation, identifying illnesses included in the potential advantages. Individuals can be treated very effectively, and the management of both individuals and public health, as well as the detection of fraud or any other illegal activities, can be done with great ease and speed. Big Data analytics can help to identify or estimate specific outcomes or developments, like which patients might get benefit from surgery and what complications could arise. Public Sector can also use big data analytics. With data analytics, the government can increase its service provision. Big data can be utilized in different domains, including campaign advertising, policy discussions, voter mobilization, donations, and many others (Achanta, 2023). Big data is generally vital for guiding future actions and ensuring optimal service provision. Big Data Analytics can help in drug discovery. To facilitate drug discovery, it is necessary to investigate the diversity of data types within large datasets. Efficient, effective, and scalable algorithms are required for this.

Role of Blockchain in E-Governance

Blockchain Technology is a vital part of Information Technology. Blockchain technology is widely recognized and valued in peer-to-peer decentralized distributed ledger systems all over the world. Blockchain technology plays an important role in ensuring the transparency of digital assets. Data is stored and recorded by blockchain technology in a manner similar to that of ledger technology. In Blockchain technology, the distributed record of transactions is perpetually updated and examined. Blockchain technology can be applied across different fields and sectors, such as business & commerce, education & training, healthcare & medical systems, government & administration, entertainment, banking & trade, among others. The number of such applications is gradually growing (Sakhipov and Baygozhanova, 2020). Blockchain technology can be divided into three categories Public Blockchain, Private Blockchain, and Hybrid Blockchain (Chen *et al.* 2018).

Blockchain Technology minimizes cost of overall transaction. It develops security and efficiency of transaction. Fraud can be minimized. It reduces systematic risks in transaction. Blockchain Technology is applicable in different fields like Cryptocurrency. Cryptocurrencies offer public all over the world instant, secure, and frictionless money. Blockchains serve as the permanent record storage for each and every cryptocurrency transaction that occurs. Since only verified transactions are allowed to be recorded on the blockchain, blockchain-based cryptocurrencies function effectively (Nakamoto, 2008; Paul *et al.* 2012). The current infrastructure of financial markets is being redefined by blockchain financial services. From backend clearing and settlement to global capital markets architecture, blockchain financial services work well (Dash and Behera, 2017). Blockchain technology can be used in financial services, including Smart Securities through Smart Contracts, Loan Origination and Servicing, and foreign Exchange Markets. Blockchain technology allows for the effective and efficient sharing of medical and health data. In cross-border payments, blockchain technology is used alongside real-time IoT operating systems (Sakhipov and Baygozhanova, 2020). It is also beneficial for managing and enhancing personal identity security. The Anti-money laundering tracking system also uses Blockchain Technology. In respect of voting mechanisms, this technology proves effective as well. This technology is also effectively used in cryptocurrency exchanges. As a result, the use of blockchain technology is steadily growing across different sectors, including Financial Services, Education & Training, Healthcare, Government & Administration, Travel & Hospitality, Retail, etc. (Dash and Behera, 2017).

Role of Internet of Things (IoT) in E-Governance

The Internet of Things plays a vital role in E-Governance. The IoT enables individuals to live and work more intelligently. The IoT also takes charge of individuals' lives. It also provides smart devices for home automation. IoT is also essential for business (Srivastava, 2018;

Suleimany, M. 2021). It provides companies a real-time perspective on the functionality of their systems, providing insights into various aspects including machine performance and supply chain and logistics operations. The IoT has numerous practical applications in the real world. The IoT applications cover consumer IoT, manufacturing IoT, enterprise IoT, and industrial IoT. IoT applications exist within the realm of E-Governance. In a smart city, IoT sensors and deployments can help in reducing traffic, conserving energy, monitoring and addressing environmental challenges, and enhancing sanitation. IoT technology has transformed existing medical devices to function intelligently, contributing to the creation of a health-related digital world. IoT-based e-health systems incorporate substantial technologies and interconnected objects to oversee, trace, recognize, administer, and archive patients' data for continuous healthcare. A mechanism that ensures interoperability among devices is necessary to assure efficient processing and utilization of resources for the effective implementation of IoT in e-health (Saqib and Al-Muqrashi, 2017)). At present, IoT can significantly improve medical research, devices, care, and emergency services. The applications of IoT in environmental monitoring are huge. This aids the government in its actions regarding protection, commercial agriculture, water safety, extreme weather surveillance, safeguarding endangered species, and more. IoT is used in government and safety, enabling enhancements in law enforcement, defense, urban planning, and economic management of G2G applications (Srivastava, R. 2018).

Role of Cloud Computing in E-Governance

Cloud Computing based e-Governance would possess the intelligence to help end users in strategic planning when human experts are unavailable. The components of the cloud that facilitate the implementation of cloud-based E-Governance include the following: —

Internet over Cloud: A majority of internet services depend on the cloud. It is estimated that almost 70% of internet users engage with cloud applications (Belwal and Sharma, 2017). Distributed Data Centers offer protection against a vast range of threats and support E-Governance applications. They distribute data among multiple centers, eliminating single ownership and enhancing security for citizen-related information. Data Center Operations ensure service availability and continuity. Different E-Governance applications can share the same data center in multiple ways. Cloud Computing technologies provide many benefits across various aspects of E-Governance (Belwal and Sharma, 2017). Scalability in the realm of Cloud Computing, IT resources can be adjusted up or down depending on demand fluctuations. Using Cloud Computing systems also leads to cost savings. There is no requirement for it to buy and set up the ICT tools and software. It provides unlimited storage capacity. In cloud computing, one can store data without limits. Since all data are stored in the cloud, users can back it up more easily, and restoring data and information is simpler. Cloud Computing permits citizens to access data and information at any time and from anyplace (Paul and Chaterjee, 2012; Al-Ruithe & Benkhelifa, 2017). Cloud Computing

is relatively good in case of energy consumption. It also provides ecosystems via virtual services. Many countries globally have initiated E-Governance services using Cloud Computing due to its diverse advantages. In India, the Government has embarked upon an ambitious initiative “GI Cloud” which is also known as “MeghRaj”. The Indian Government launched an initiative in December 2013 to adopt Cloud Computing Technology for E-Governance (Paul and Ghose, 2012; Paul *et al.* 2012). The goal of Megh Raj in India is to accelerate the e-services in the nation. It will be act as a bridge between Indian Government departments and various State Government departments and citizens and business organizations using the Internet and mobile services (Paul and Chaterjee, 2012). In India, Cloud-Based nodes were setup in National Data Center of National Informatics Centre (NIC). Cloud Computing Technology is used in e-Gram Panchayat to facilitate internal governments operations. NIVARAN which is a Grievance Portal Launched in India on Rail Cloud. This is a platform which provides solution of service related grievances of serving and former railway employees (Paul and Ghose, 2012).

Role of Edge Computing in E-Governance

Edge computing is a distributed model of computing that locates enterprise applications nearer to the sources of data. This closeness to data at its origins offers significant advantages, including quicker insights, enhanced response times, and enhanced bandwidth availability. Edge computing offers advantages in E-Governance, including— Rapid response. Edge computing provides rapid responses in certain situations where the demands for real-time or extremely rapid results. Edge Computing can process the huge amount of data at lower cost. Users favor maintaining local control over vital data instead of uploading it to the cloud. Different E-Governance applications use edge computing. It is also used in transportation, retail, manufacturing, and healthcare. Autonomous vehicles generate large amount of data and collect information regarding location, velocity, traffic situation, state of the road, and this data needs to be examined in real time while the vehicles are moving. Here, each vehicle corresponds to an edge. The healthcare industry has collected sufficient amounts of patient data from various devices, sensors, and other medical equipment. That significant amount of data necessitates edge computing to implement automation and machine learning processes for accessing the data.

FINDINGS

The research finds that emerging technologies have fundamentally transformed conventional governance models into more responsive, transparent, and citizen-centric systems. E-Governance initiatives supported by digital technologies have minimized bureaucratic delays, reduced manual interventions, and enabled governments to deliver services efficiently. The shift from paper-based administration to digital platforms has developed record management, enhanced accessibility, and ensured continuity in governance processes. One of the most significant

findings is the increasing role of Artificial Intelligence in governance decision-making. AI-driven systems assist governments in predictive analysis, policy simulations, fraud detection, and automated service delivery. Machine learning algorithms analyze large volumes of data to identify patterns, support evidence-based policymaking, and forecast future trends. AI chatbots and virtual assistants have advanced citizen engagement by providing 24×7 support and instant grievance redressal. The study finds that Big Data analytics has become a crucial tool in modern E-Governance. Governments create large amounts of data from social welfare schemes, digital payments, and citizen interactions, IoT devices. Big Data technologies assist in processing structured and unstructured data to evaluate policy outcomes, monitor service performance, and identify gaps in implementation. Blockchain technology has emerged as a powerful mechanism to ensure data integrity, transparency, and trust in E-Governance systems. The findings refer that blockchain-based applications in digital identity, land records, public procurement, and voting systems reduce corruption and manipulation. The study finds that IoT plays a crucial role in smart governance initiatives. IoT-enabled sensors and devices support real-time monitoring of urban infrastructure, waste disposal, water supply, environmental conditions, and traffic management. The study finds that cloud computing provide cost efficiency, scalability, and interoperability among government departments. The findings disclose that despite technological advancements, the digital divide exists. The study finds that cybersecurity remains one of the main concerns.

RECOMMENDATIONS

Governments should invest in robust digital infrastructure, including high-speed internet connectivity, secure networks, and data centers. Expanding broadband and mobile connectivity in remote areas is necessary to ensure inclusive E-Governance. Public-private partnerships can play a crucial role in infrastructure development. Continuous training programs should be introduced for government officials to increase their digital and technological skills. Specialized training in AI, Big Data, cybersecurity, and blockchain is necessary to build institutional capacity. Digital literacy programs for citizens should also be strengthened to advance adoption of E-Governance services. E-Governance initiatives should prioritize public needs and usability. Government portals and mobile applications must be user-friendly, multilingual, and accessible to persons with disabilities. Feedback mechanisms should be integrated to improve service quality and responsiveness. The study strongly recommends the development of comprehensive cybersecurity policies and data protection laws. Governments must implement encryption, multi-factor authentication, regular security audits, and incident response mechanisms. Establishing dedicated cybersecurity agencies and promoting ethical hacking initiatives can enhance resilience. AI systems used in governance should be transparent, accountable, and free from bias. Ethical guidelines and regulatory frameworks must be established to govern the use of AI in public administration. Blockchain

adoption should be prioritized in areas prone to corruption and inefficiency, like land records, welfare distribution, public procurement, and voting systems. Pilot projects should be scaled up based on performance evaluation and citizen acceptance. The study recommends the advancement of interoperable platforms that enable seamless data sharing across government departments. Standardized data formats should be adopted to avoid duplication and improve coordination. Integrated service delivery platforms can increase efficiency. To bridge the digital divide, targeted interventions are required. Subsidized devices, and awareness campaigns and community digital service centers can improve access for marginalized groups. Content should be localized to address linguistic and cultural diversity. Governments should boost innovation by collaborating with startups, academic institutions, and technology firms. This type of collaborations can accelerate digital transformation. Regular monitoring and evaluation frameworks must be implemented to assess the performance of E-Governance initiatives. Transparency in reporting generates public trust. The study recommends updating legal and regulatory frameworks to accommodate emerging technologies. Laws related to data privacy, digital identity, cybersecurity, and electronic transactions should be harmonized to support innovation while safeguarding citizen rights. Emerging technologies must be aligned with sustainability goals. Energy-efficient data centers, paperless governance, and green IT practices can minimize environmental impact.

CONCLUSION

Digital Governance indicates to executing governance processes digitally in order to provide digital services. Digital Governance is also referred to as online governance, electronic governance, internet governance, transformational governance, and connected governance. E-Governance denotes the application of Information and Communication Technology by governmental or public entities for the purpose of public governance. E-Governance provides a systematic, suitable, systematic, and transparent means for citizens to access government services. Electronic Governance represents the most effective use of ICT. E-Governance enjoys widespread popularity globally. The different Digital services are now accessible in our country, and citizens are obtaining them even in rural areas. To implement E-Governance, a variety of technologies are necessary, including databases and networks, as well as various emerging technologies such as Big Data, Cloud Computing, IoT, Blockchain, AI, and Edge Computing. This paper describes and outlines the applications of emerging technologies (Cloud Computing, Big Data, IoT, Blockchain, AI, and Edge Computing) in the context of E-Governance.

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