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Efficient and Ubiquitous Software Architecture of e-Governance for Indian Administrative Services

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***Abstract*—** Designing an effective software architecture for e-governance is definitely a challenging task when it is related to Indian Administrative services. Although there were multiple set of research work conducted in the past, but majority of the prior research has focused on designing e-governance architecture for a specific issues. Hence, the proposed paper introduces an efficient architecture that supports e-governance of India on highly distributed evaluation environment considering the potential of cloud / ubiquitous computing. It is also felt that proposed framework should be rendered secure by incorporating cost effective cryptography that takes less storage and are more efficient to circumvent illegal activities and misuse of resources in e-governance application. Finally, the proposed system is compared with existing system on the basis of browsing performance, response time, and security to show that novelty nature of the software architecture.

Keywords-component; E-Governance, Software Architecture, Indian Administrative Services, Ubiquitous.

I. INTRODUCTION

The word "electronic" within the term e-Governance implies technology driven governance. E-Governance [1] can be illustrated as application of information and Communication Technology for delivering government services, exchange of data communication transactions, integration of assorted complete systems and services between Government-to-Citizens, Government-to-Business, Government-to-Government yet as back office processes and interactions among the whole government frame work. Through the e-Governance, the government services are going to be created out there to the citizens during a convenient, economical and clear manner. The 3 main target teams that may be distinguished in governance ideas are Government, citizens and businesses/interest teams. In e-Governance there aren't any distinct boundaries. usually four basic models are available-Government to client (Citizen), Government to staff, Government to Government and Government to Business. The prime concern of this decade is to ascertain and guarantee a much better manner of administrative management, communication and development with the employment of data and data adjusted services. Crossing the boundary of non-public computations and communications, the uses of digital media for larger levels of management has been initialized early within the century. E-Governance might merely be thought of as an extension of this trade. With the improved facilities of technology for providing good and straightforward living, E-Governance has become a major demand within the world for guaranteeing transparency, effectiveness, responsibility and efficiency throughout the assorted sectors of government as well as decision-making, public policy building, access to data etc [2]. whereas developed countries of the western world have already been benefited with the effective and multidimensional use of computer assisted data and Communication technology, most of the developing and under-developed countries of Asia (especially in south Asia) are still grasping to form sense of the pertinence and effectiveness of data and Communication Technology in determination the old issues. From varied purpose of views, variety of definitions of e-Governance exist accenting on specific activities and functionalities. In developed countries, there are a few of catalysts that ultimately mobilizes the method of implementing electronic governance. There are a few of alternative issues with developing countries, as well as absence of infrastructure, resistance to alter, lack of education, natural disasters, power shortage, unavailable internet facility that hampers the implementation of electronic governance severely. The main contributions of this paper are: first of all, it proposes a software architecture for implementing e-governance. it's the novelty of this paper that, it takes the factors of electronic governance under consideration whereas previous researches (to be best of our findings), primarily focuses on specific problems or factors of e-governance. Secondly, this paper proposes a gradable development or implementation of electronic governance using cloud environment, providing a transparent indication of each short-range and long-term designing and policy making. This staged implementation policy could facilitate effective coming up with and precise service discovery with complete support of incorporating the prototyping aspects of flourishing e-governance implementation. Thirdly, we re-investigate the particular challenges and barriers on the way to establish e-governance in developing countries like India. We have also compared the existing schemes and have analyzed their effectiveness from the browsing performance, response time, and security. Section 2 discusses related work followed by problem description in Section 3. Section 4 discusses about proposed architecture followed by implementation in Section 5. Section 6

discusses about the performance comparative analysis and in section 7 we make some concluding remarks.

II. RELATED WORK

As many countries have realized that there is a need to develop a one national system that would reach the urban and rural community, the effort to build e-Governance or e-Government systems was envisaged. This section discusses about the prior research work in the same field.

Dwivedi and Bharti [3] have discussed the problems and acceptability of e-governance in India. According to the authors, 81% citizens report reduction in corruption, 95% find cost of e-governance affordable and 78% favors fast of delivery of services. e-Governance is a way to solve the social as well as economical problems exists in the developing countries like India.

Misra [4] has focused on a national agenda having all the dimensions of MMP and has the scope to include all the categories. Architectural challenges seem to be enormous. OA analysis indicates that guidelines are well formulated with transparent roles and responsibilities. Each layer of OA has adequate mechanism to carry out the task. ISA framework indicates that there is much scope to provide a well designed framework. On priority, a "systemic convergence" approach is needed. WPI guidelines have the provisions for convergence.

Paul et al. [5] have analyzed the need and possibility of Enterprise Architecture concept in the Indian context to achieve the e-Govt interoperability for integration of e-Governance services and they proposed a framework for this dilemma. This framework is helpful to arrive at the maturity level of e-Government in India that is expected in future by GOL.

Chakravarti et al. [6] has presented in this paper, result of the analysis of collected data and the proposed solution is based on the requirements identified in these states. Though it is presumed that the present scenarios of other states are similar, it would be necessary to perform a study of their requirements before implementing the proposed solution. As this enterprise architecture framework is platform independent and follows open standards, it can be implemented irrespective of technology or platform being used in the states.

Mujtava et al. [7] have proposed in this paper, they will attempt to provide an insight regarding: a definition of e-Governance to build a business case for its adoption. A brief discussion on evolution of e-governance technologies. Present Scenario of e-governance efforts in India. Strategies/action plan for designing e-government projects for addressing immediate objectives with a vision for future in mind

Marjit et al. [8] have illustrated a way to facilitate the issue of discovering the university e-governance services for student clearance certificate that addresses a user need. In this paper, it is also shown how a generic university governance service model can be expressed by means of WSML -a fully fledged logic programming language for describing Semantic Web Services. A novel concept regarding the security of web services is introduce here to protect, authorize, authenticate the propose model in e-governance system.

Mishra [9] have explained, it is posited that citizen participation with developmental perspectives would lead to better citizen centric services and would also provide scope for demand driven growth of e-governance services. In order to assess the suitability of the e-governance projects nationally for scale up, architectures and technology adoption and acceptance model are considered relevant in this paper to present an evaluation model. Through this evaluation model, a case of national e-governance plan is discussed to appreciate the relevance of providing citizen-centered e-governance services.

Mampilli et al. [10] have illustrated, the use of Semantic Web Technologies for web implementations in E-Governance will benefit end users as well as the decision makers in the government. The end users would be able to get a transparent view of the system in work and provide their thoughts on the same. At the same time the various government agencies would be able to do proper data analysis and decide on the future course of actions in a more accurate manner.

Mbale [11] have demonstrated, the architecture was built with Multiples of interlocking function blocks that interleaving relationships with one another forming a sophisticated interaction that manoeuvred with information sharing. In view of these, the eGToH architecture was designed as an integrative and interoperability framework which adapted the evolved ICT technologies including the past, present and future changing requirements.

Morison [12] have proposed in this way the provision of public services online may be thought to offer a new level of openness in the operation of government along with levels of convenience in public services that are at least as good as those in the private sector where the internet is available routinely as an additional route for collecting information and accessing various services. There may even be cost savings although this is by no means guaranteed. In addition, computer networks are good at storing, manipulating and quickly transmitting data.

Janssen et al.[13] have analyzing discontinuities in the architectures coordinating back and front office applications five stages are derived. The five-stage model consists of 1) no integration, 2) one-to-one messaging, 3) warehouse, 4) broker and 5) orchestrated broker architecture. Public decision-makers can use these stages as a guidance and direction in architecture development, to reduce the complexity of the progression of e-government initiatives, to communicate changes to the rest of the organization and to provide milestones to evaluate and control cost of architecture development.

Peristeras et al. [14] have proposed the Governance Enterprise Architecture (GEA) as a set of domain models that serve as a top-level enterprise architecture. To this point, the development includes five high-level generic process and objects models. Namely, they present the GEA mega-process model, the GEA interaction model, the GEA public policy formulation object model, the GEA service provision object model and the latest development of the GEA object model for the overall governance system.

Contenti et al.[15] have illustrated the approach followed and the results so far achieved within the Eu-Publi.com research project, are presented. The discussion on the conceptual and design architectures of the Eu-Publi.com distributed, peer-to-peer

system is enriched with results about the experimentation conducted on one of its core components.

III. PROBLEM DESCRIPTION

Since 1996, the administrative employees were fortunate enough to work closely with a variety of govt. and commercial concerns, investigating the continuing trends in the field of e-governance area. It can be said that although lots of efforts have been made in the creation of infrastructure and internal information handling by govt. bodies as well as public services, the diffusion of technologies in moving towards e-governance have been rather slow. This may primarily be attributed to the following reasons:

- *Lack of IT accomplishment and awareness relating to advantages of e-governance*: there's general lack of awareness relating to advantages of e-governance further because the method concerned in implementing productive G-C, G-G and G-B projects. The administrative structure isn't intermeshed for maintaining, storing and retrieving the governance information electronically. the overall tendency is to get the information from the files (print) as and once needed instead of using Document Management and work flow technologies. Recently the utilization of DMS and work flow technologies has been ready to notice its use solely in those departments wherever there's perceptible lightening of work of the subordinate workers.
- *Underutilization of existing ICT infrastructure*: To a bigger extent, the computers within the department are used for the aim of data processing solely, leading to the underutilization of the computers in terms of their use in data processing for supporting management choices. The time gap between the acquisition of the hardware and development of the custom applications is thus massive that by the time application is prepared to be used, the hardware becomes obsolete.
- *Attitude of government Departments*: The scientific discipline of government servants is sort of totally different from that of private sectors. Historically the govt. servants have derived their sustenance from the very fact that they're vital repositories of govt. data. Therefore any effort to implement DMS and work flow technologies or transfer out the modification within the system is met with resistance from the govt. . servants.
- *Lack of coordination between Govt. Department and resolution developers*: planning of any application needs a awfully close interaction between the govt. . department and therefore the agency developing the solutions. at the present the users in govt. departments don't contribute enough to design the solution architecture. Consequently the solution developed and enforced doesn't address the wants of an e-governance project and therefore doesn't get enforced.
- *Resistance to re-engineering of division processes*: productive implementation of e-governance comes needs uncountable restructuring in body processes, redefining of administrative procedures and formats that finds the resistance in most the departments in the least the degree. in addition there's lack of experience of division MIS executives in exploiting data processing techniques, updation and assortment of real time content onto web site etc. thus the content as is collected or maintained by varied e-governance portals is unreliable or full of gaps. In such a state of affairs, its troublesome for any e-governance resolution to realize its supposed results.
- *Lack of Infrastructure for sustaining e-governance comes on national level*: Infrastructure to support e-governance initiatives doesn't exist inside government departments. The agony is that the govt. departments don't seem to be equipped to be in a very position to project the clear necessities nor are there any tips for involving personal sector. no matter efforts are created by varied govt. organizations is also outlined as islands of automation. The infrastructure creation isn't guided by a consistent national policy, however depends on the wants of individual officers championing a number of comes. Therefore, the specified networking and communication equipment is either non-existent in govt. departments, or if it exists in the least , it doesn't serve any tangible purpose as so much because the demand of e-governance project worries. the utilization of property choices provided by govt. agencies like NICNET etc. are utilized in a awfully restricted manner for knowledge transmission purpose between varied locations viz. Distt., State , Center etc. and is especially utilized for e-mail and web purpose solely.

Most state govts. have shaped the IT task force and have their IT policies in situ. though policies could have lofty goals, a lot of appears to own happened solely in automation and automation the disadvantage is that these IT policy documents don't seem to be created primarily based upon the wants and inherent capabilities of the state however are supported the surveys and methods utilized by different nations or different states. Although its awfully informed take examples from the productive e-governance methods of different states and countries, it is equally essential that we tend to customize our state policies when a careful study of the parameters applicable to the actual state in question.

IV. EVOLUTION OF NEW ARCHITECTURE

The real challenges is the way to develop and sustain prospering e-governance projects and deliver state of the art e-services to citizens. sadly its not as simple as adding “e” before of your service delivery mechanism. prospering e-governance initiatives will never be taken hastily. significantly for the democratic nation of the billion individuals like India, e-Governance ought to change seamless access to data and seamless flow of knowledge across the state and central government within the federal setup. No country has so far enforced an e-governance system for one billion individuals. a number of the necessities for implementing prospering e-governance across the state are :

- e-Governance framework across the state with enough bandwidth to service a population of 1 billion.
- Connectivity framework for creating the services reaches rural areas of the country or development of different means that of services such as e-governance kiosks in regional languages.
- National citizen database which is the primary unit of information for all governance vertical and horizontal applications across the state and central governments.

- E-governance and ability standards for the exchange of secure data with non-repudiation, across the state and central government departments seamlessly.
- A secure delivery framework by means that of virtual non-public network connecting across the state and central government departments.
- Datacenters in centre and states to handle the division advancement automation, collaboration, interaction, exchange of knowledge with authentication.

For success of associate e-governance project and superior service delivery, it's imperative that the government agency focuses on whole national expertise. that specialize in the national is important for long run success. The govt. agency has to integrate data from all points of national interaction. the design for e-Governance has to make sure that the design elements are extensile and scalable to adapt to the dynamical environments.

V. PROPOSED ARCHITECTURE

The proposed architecture of e-governance is based on the fact that the architecture should cater up the distributed needs of any cloud services pertaining to Indian administrative acts and should provide a secure cloud communication (ubiquitous) between the system and the user. The prime target of the architecture is to develop an efficient framework for e-governance using cloud computing model and thereby furnishing higher distributed nature of the proposed architecture. The system will use dual factor authentication system by producing Unit Instant Secure Token (UIST) in the forward direction to generate multiple authentications in cloud environment from an initial seed in a parallel process with the service provider itself by utilizing two different types of hash functions, which come with a nested chain. The resulting chain provides forwardness and infiniteness and it should run on multiple systems of wired or wireless network. The cumulative architecture of the proposed system is as shown in Figure 1. The proposed architecture is mainly partitioned in two components:

- Registration Phase: The user gets the two different hash functions, and an initial seed, established on their e-governance application that can be accessed both from PC as well as from mobile phones. To ensure that the information is completely shared with the service provider, the seed is produced by the shared and unique parameters of the host and user, e.g., the International Mobile Equipment Identity (IMEI), International Mobile Subscriber Identity (IMSI), and enrollment date.
- Distributed User Verification Phase: The steps of the authentication process between the distributed user on cloud and service provider are like this; the user logs in to the e-governance application, requesting access. As a response to this access request, a secure session is established, allowing the user to enter their authentication privileges, i.e., user's name and password, the first factor of authentication, what the user knows. Also the user provides the server with their UIST's present status. The existing status permits the administrative server to synchronize the generated seed with the user's current seed to get the same seed value on both sides before sending a challenge. The administrative server randomly challenges the user with new indexes. The user enters those indexes, in their USIT generator to get the corresponding USIT. The user responds with this corresponding UIST. The server compares the received USIT with the calculated one. According to the server check, done in the previous step, the server will transfer an authorization execution or a communication termination.

Through the registration process, the user gets two different hash functions, which could be SHA-1 and other could be MD5, along with an initial seed, "S_{int}" as the concatenation of the IMEI, IMSI, and registration time, which could be a longer digital value assuming IMEI, IMSI, and the time-stamp. After accessing into the administrative application using a different and static username and password, the first factor of authentication, the server asks the user for the UIST's current status. If the user has generated numerous UISTs without using them, he might have reached an UIST status of some specific large integer value (x). The user will submit his current status to the administrative cloud server to allow the server to estimate the current seed that interprets that the server has estimated x^{th} cascaded hashes of its initial seed "S_{int}" using the SHA-1 algorithm, to be synchronized with the client. After that the administrative server sends a random challenge value of new indexes which means the user has to calculate his session UIST. The administrative server has to also estimate the same value in a parallel process, and as soon as the client responds, the administrative cloud server will match the two values to give either a yes or no.

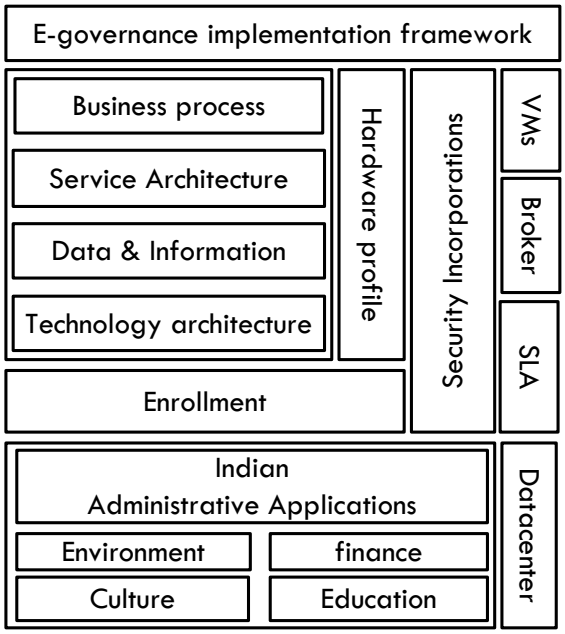

Figure 1 Proposed Architecture of e-governance

Figure 1 highlights the architecture of the proposed system. Business Process component is basically concentrated about listing various operational procedures of administrative services and enabling communication across various modules of Indian Administrative Sections. Service components concerns about the defining set of services, their relationship and dependencies and the processes to be followed for each services offered by different government agencies. Data and information components concerns enlisting all the data elements associated with services, the data and meta-data associated with this. Finally, technological component defines the software and hardware platforms based on

standards for flexibility and security. The proposed study considers the cloud computing environment for designing the e-governance implementation framework that considers data centers hypothetically being classified into master and slave type. Master data center is located at Cloud provider's administrative premises. User's accounting on pay-as-you-go basis is completed here. Slave data-center are geographically scattered to serve user's requests in minimum physical distance. Users directly communicate or via brokers submit requests, which automatically reach at master data-center. Master data-center creates user instance at appropriate slave data-center considering minimum latency. Quality of Service (QoS) and pricing negotiations are settled through SLAs. Master data-center scans SLA each time to host needs of the users. After receiving a request for creating an instance, master data-center look for the availability of resources in the user's local data-center. If desired resources are available, then user gets his required instance and run his application with minimum latency. Master Datacenter searches other slave data-centers of same zone for resources if they are not available on the location of the user. If resources are not available even in same zone and user has opted for multiple zones then master data-center looks for resources in other zones.

A Unit Instant Secure Token is valid for only one login session in administrative applications. USIT also avoid a number of shortcomings which are associated with traditional systems of passwords. Multi-factor verification is an approach to authenticate distributed cloud resources of administrative services which requires the presentation of two different kinds of evidence that someone is who they say they are. It is a part of the broader family of multi-factor authentication, which is a defense in depth approach to security. Authentication is the act of confirming the truth of an attribute of a datum or entity. This might involve confirming the identity of a person, tracing the origins of an artifact, ensuring that a product is what it's packaging and labeling claims to be, or assuring that a computer program is a trusted one. The proposed work mainly constitutes of two modules e.g. administrator (or service provider) and student. The administrator basically supervises the application by assisting in creation of account as well as relaying the services based on the digital content used by the student user. As the application will consist of a privilege access for the student, so an efficient and robust authentication as well as authorization is highly required.

Conventional architectures in e-governance have been long acknowledged as a big security and management threat to IT administrators of enterprises. Usually, a simple password was used repeatedly by a user or written down carelessly on a piece of paper. Unlike the traditional single-factor static password, Unit Instant Secure Token changes each time the user logs in. Thus, on one side, the users are forever freed from remembering static password by simply using a detached UIST generator or token; on the other side, sensitive personal information in the IT systems is better protected against unauthorized access since relay attacks are effectively prevented. To face the increasing security demands on IT systems nowadays, it is highly advised that enterprises introduce two-factor authentication methods into their IT infrastructure. The UIST solution, as the most adaptable and flexible scheme, is becoming the most popular information security solution in the field with cost-effective user UIST tokens and advanced security.

VI. IMPLEMENTATION & RESULTS

The proposed architecture for e-governance system is evaluated on Windows 32-bit OS with 1.84 GHz processor with broadband connectivity of 100 Mpbs. The programming is done on MyEclipse IDE. The experiment for the proposed system is done on real time HTC Smartphone with Android Jelly Beans OS for performing ubiquity. Therefore, Android Development Tools (ADT) is used as it is a plug-in for the MyEclipse IDE that is designed to give a powerful, integrated environment in which to build Android applications. The proposed system will be experimented with active wireless connectivity between the system and Android enable device.

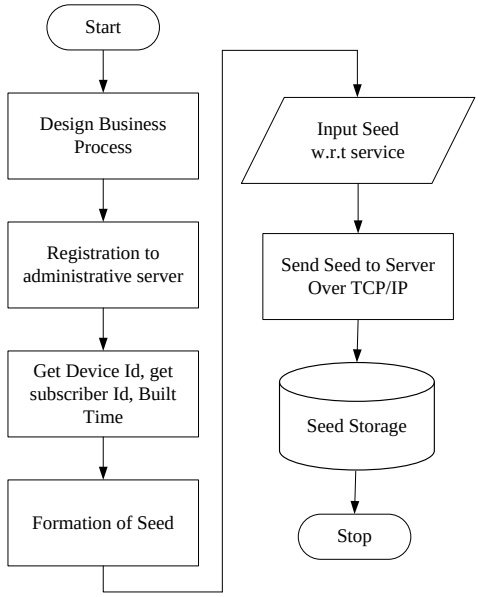

Figure 2 Processing operation of registration phase

Fig.2 exhibits the processing operation of the registration phase which is one of the preliminary functions of the architecture of e-governance. For the sake of evaluation, the administrative services considered are environment, finance, culture, and education system of Indian administrative services. The initial verification for distributed user is designed where preliminarily the user has to register on the basis of business process for accessing a new account where they have to furnish all the administrative service details. Upon considering the hardware profiles of the user, a seed is formulated which is then acted as an input along with the services to be considered for Indian Administrative acts. The seed is forwarded to the server over cloud environment using TCP/IP, where the seed is stored in administrative server database. Depends on the user ID and the password entered for the first time by the user, the availability of the processing in mobile platform (Android) should be there for appropriate user/client authentication. The authentication by banking web service is responsible for performing the actual UIST authentication by determining whether the provided UIST value demonstrates that the named user has knowledge of the secret key. The Web service exposes a method that returns true for a successful authentication.

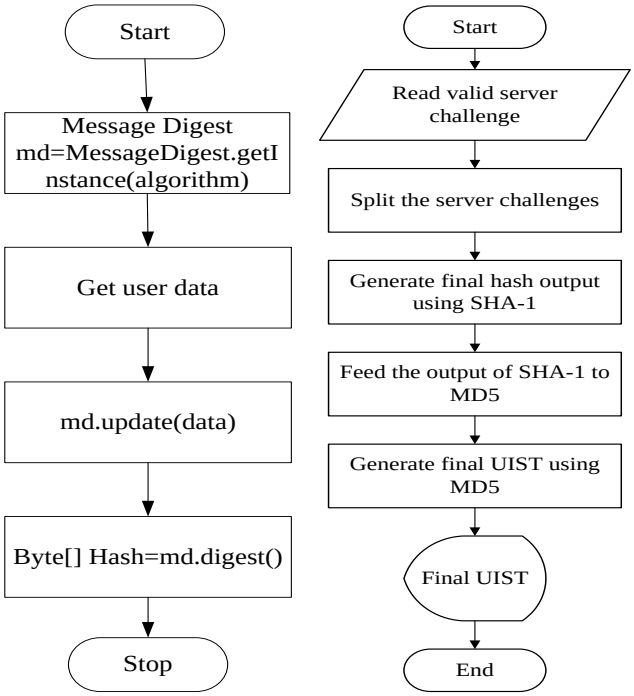

Figure 3 E-governance Security Incorporations

Fig. 3 exhibits the security incorporations of e-governance framework. The main purpose of the hash function implementation (Fig.3(a)) for securing the communication among all the services of Indian Administrative acts. The design uses hash-based USITs for cryptographic hashing algorithms to compute the password. A cryptographic hash is a one-way function that maps an arbitrary length message to a fixed-length digest. Thus, a hash-based UIST starts with the inputs (synchronization parameter, secret key, PIN), runs them through the one-way function, and produces the fixed-length password. The system also uses two hash functions. The input is instances of hash and output is encrypted data. The prime purpose of the next module in cloud environment (Fig.3(b)) is to generate the ultimate UIST on the mobile device that will be used for final authentication purpose. After the challenge is generated from the administrative server, it is read and split to generate the final hash output using the SHA-1. Also, the final feed of the output of the SHA-1 is given to the MD5, which finally generates the final UIST. The input is administrative server generated challenge and output is finally generated USIT. Using this, various administrative services can be accessed using the cloud environment from any part of India with highest security measures and thereby prevent misuse of any of the illegitimate request. The system is thereby highly ubiquitous and secure.

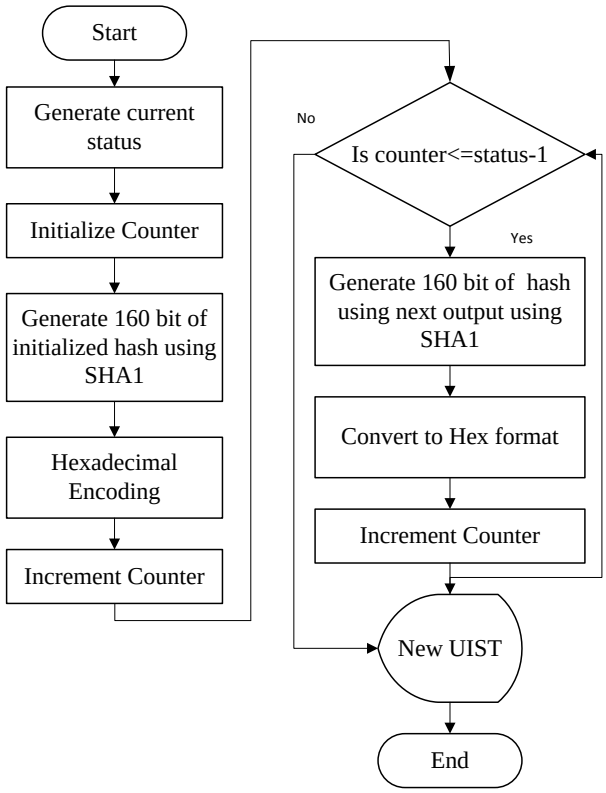

Figure 4 Final accomplishment of e-governance access

Referring to the issues of implementation of e-governance effectively was found that majority of the individual handling the machines are not up to the mark in technical knowledge, hence, the proposed architecture needs to be designed in such a way that it provides higher degree of user Comfortability in handling the machines along with ubiquitousness. Therefore, the prime purpose of the module reflected in Fig.4 is to generate the human readable UIST on the ubiquitous device that will be used for authentication purpose for handling e-governance applications. After logging into the service provider‘s website using a different and static username and password, the first factor of authentication, the server asks the user for the UIST‘s current status. If the user has generated numerous UISTs without using them, he might have reached an UIST status. The user will submit his current status to the server to allow the server to calculate the current seed. After that the server sends a random challenge value of new indexes which means the user has to calculate his session UIST. The generated 160 bit hash using SHA-1 is converted to Hex format. The input for this system is current status of the user generated on ubiquitous device and output is new human readable UIST. Finally the module discussed in Fig.4 performs the final authentication of the human readable UIST when it is fed to the server. The distributed user gets the two different hash functions along with seed. To ensure that the information is completely shared with the service provider, the seed is produced by the shared and unique parameters of the host and user. The server randomly challenges the user with new indexes. The user enters those indexes, in his UIST generator to get the corresponding UIST. The user responds with this corresponding UIST. The server compares the received UIST with the calculated one. According to the server check, done in the previous step, the server will transfer an authorization execution or a communication termination. The

input was considered as distributed user details along with hardware details of mobile device and output was considered as final authentication of UIST at administrative server of e-governance applications.

VII. PERFORMANCE ANALYSIS

The performance analysis of the proposed architecture of e-governance was done with respect to evaluation parameters e.g. i) Browsing Performance, ii) Response Time, and iii) Security Strength. For the purpose of benchmarking, the proposed system is compared with the work done by Sharma [16] and Islam [17]. Sharma [16] has presented an intelligent & energy efficient Cloud computing architecture based on distributed data-centers to support application and data access from local data-center with minimum latencies. Islam [17] has described complementary tasks such as database implementation, system development, web related task etc. for e-governance in Bangladesh. Both the work has some efficient results explored with respect to architecture design and moreover as the work, matches with the proposed aim of the study, so, they are considered for performance analysis.

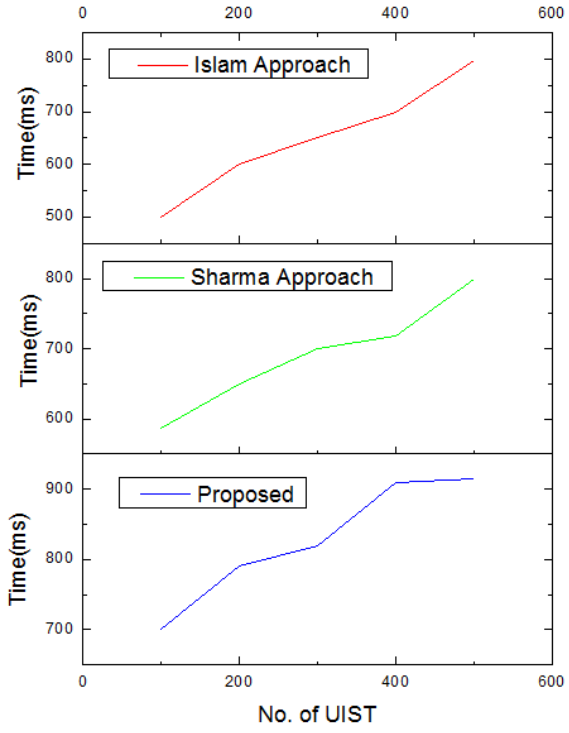

Fig 5 Browsing Performance

Fig.5 illustrates the browsing performance of the proposed study compared with techniques adopted by Sharma [16] and Islam [17]. Browsing performance basically evaluated the average access time on the UIST list of typical sizes. As can be seen, the access time shows linear growth (with an outlier on lists of size 400, but with a control sample of only 10 values this can be expected). Also, the average access time is below 1 second for lists of sizes from 100 to 500 OTPs, which is acceptable for proposed system. However, the Sharma [16] and Islam [17] approach has no consideration of UIST concept for which reason, the browsing performance on ubiquitous platform is degraded with time difference of approximately 100 ms in each.

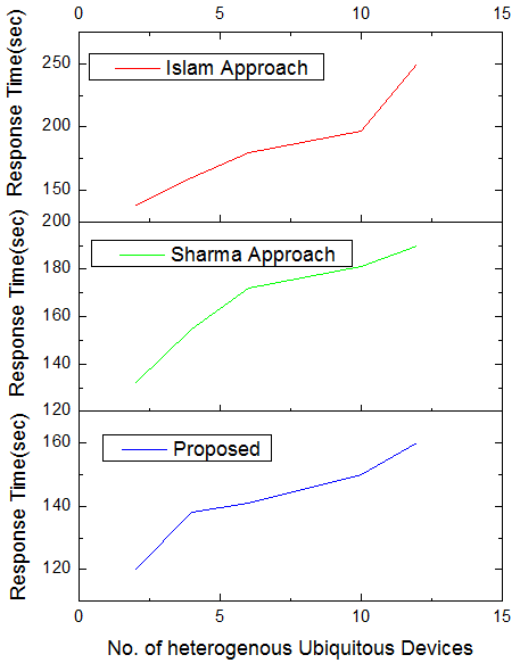

Figure 6 Response Time

Fig.6 exhibits the average response time of the proposed study as compared with the approaches considered by Sharma [16] and Islam [17]. Response time attribute was selected for performance analysis because the proposed system adopts the cloud environment considering heterogeneous ubiquitous devices for accessing the resources of e-governance application by multi-user, where response time against every request will act as an indicator of the efficiency of the proposed architecture. The above fig.6 demonstrates that with the increase of number of heterogeneous ubiquitous devices, the proposed system maximum response time observed is approximately 160 sec whereas Sharma [16] approach accomplishes approximately around 180 sec and that of Islam's approach [17] is around 250 sec. The prime reason behind this is the mutli-tier design of proposed architecture which parallel operates on business processes along with SLA incorporations, which controls the entire management of broker system to process the task from availability of distributed system. Moreover, the administrative server stores vita information which can be accessed from multiple heterogeneous ubiquitous devices. This consideration was not the part of the architecture implementation by Sharma [16] and Islam [17] resulting in higher exponential rise of average response time.

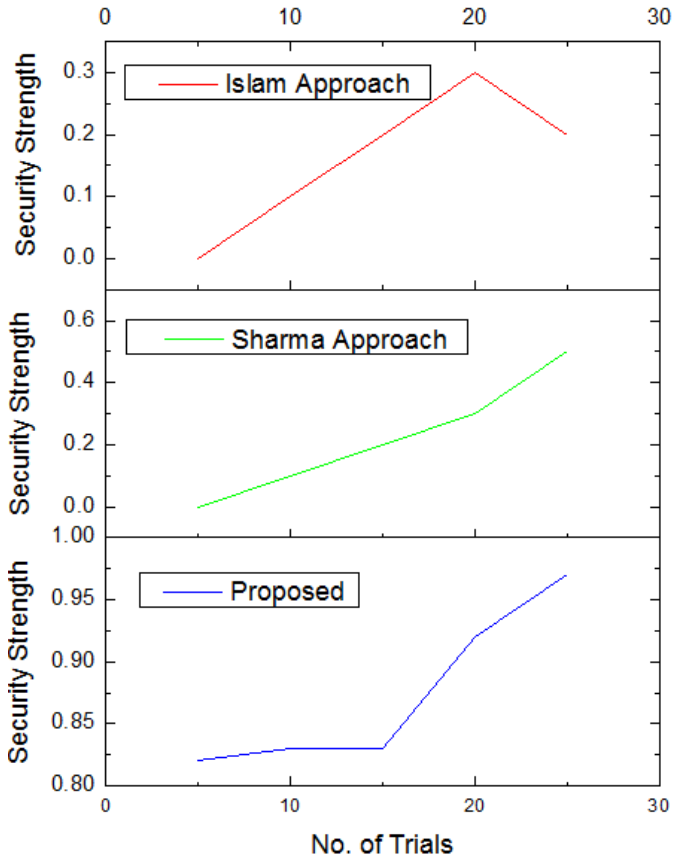

Figure 7 Security Strength Analysis

Fig.7 highlights the security strength analysis of the proposed study as compared with the techniques owned by Sharma [16] and Islam [17]. Estimating the security parameters are quite a non-trivial one. We consider security attributes e.g. Privacy (S_{P1}), Confidentiality (S_{P2}), Non-Repudiation (S_{P3}), and Anonymity (S_{P4}). Therefore Cost of Security Strength is estimated by considering statistically,

$$\cos t = \sum_{i=1}^{4} S_{pi}$$

In the above equation, S_{Pi} is the respective security protocols with i=1 to 4, representing the above mentioned security attributes. We consider evaluating the architecture on 30 trials in completely distributed set up of experiments. The proposed security incorporation is pretty strong enough due to the inclusion of multi-factor authentication system using UIST. The usage of UIST ensures the less storage and more healthy generation of authentication factors which expires after every use. It also identifies the user from their hardware profiles when they adopt heterogeneous accessing devices. Moreover, it is also user-friendly, as it generates the password that is quite human readable that allows the government official on audit in administrative services to perform cross verification of online users. However, such security incorporations was never considered in [16] ,[17], and many other works which discusses about software architecture of e-governance in the past exclusively related to Indian Administrative Services.

VIII. Conclusion

The proposed study discusses robust, scalable, and highly secure software architecture of e-governance where a novel multi-factor UIST-based authentication scheme has been proposed using ubiquitous devices as they are becoming more and more powerful devices for common people. The architecture allows more number of distributed systems that can be connected from remote corners of the country to manage the resources of dynamic need pertaining to Indian Administrative Services. In order to avoid misuse and illegal activities of the proposed architecture (As it is highly distributed where chances of intrusion, illegal activities are always on the rise to be expected), the proposed system uses a novel verification protocol provides efficient UIST generation using two nested hash functions. The proposed technique has been illustrated to an online authentication process using cloud environment where the policy was found to achieve improved characteristics than the other techniques discussed in performance analysis section. It is also strongly felt that usage of the proposed system in real-time implementation could bring out revolutionary success on e-governance plan of cloud architecture with following advantages.

- Consistent / flexible / scalable e-Governance architecture all over the country can be ensured as against the heterogeneous architecture due to procurement of IT infrastructure from autonomous government agencies.
- There is no dependency of investment on expensive infrastructure, pay for the updates or license and manage the architecture leading them to a substantial cut in the government's annual budget for IT infrastructure.
- Governments can focus on making new policies of e-Governance convenient for the intended users rather than wasting time on technical and operational overheads to maintain IT infrastructure.

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