

The Challenges for Authentication in Indian e-Governance System (A Survey on Indian administrative staff)

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ABSTRACT

E-Governance is the process to deliver public services to citizens through the Information Communication Technology (ICT) with reliability, transparency, efficiency with- out breaking the concept of cost-effectiveness. Authentication is the process to provide security to any ICT based system same to e-Governance, from unauthorized access. There are so many remote user authentication schemes using smart cards that operate in multi-server environment. But there are some authentication bottlenecks that these schemes suffer from. In this paper, we explore the existing e-Governance authentication systems of various countries along with the analysis of Indian authentication framework for e-Governance (e-Pramaan). Further we present a study about the impact of e-Governance on Indian administration, and highlight the basic requirements, feedbacks and problems of existing e-Governance system through a survey. We validate survey results and finally find the requirement of strong, integrated and unified authentication system for Indian e-Governance system.

Keywords: E-Governance, electronic governance, authentication, e-Authentication, authentication framework

I. INTRODUCTION

E-Governance is an ICT enabled tool to manage and deliver information/services for any scale of organization/group of people with reliability, transparency and efficiency, without breaking the concept of cost-effectiveness. Huge manpower required to deliver governance services manually for big and developing country like India with worldwide second largest population. [1], [2] But, when governance transforms to e-Governance then due to inherited property of ICT, security threats are challenge for all stakeholder. [3]

India is also one of the emerging nation which implement e-Governance with serious and effective efforts. National e-Governance Plan, e-Kranti, Digital India, etc. are some examples to reflect the severity of governance towards e- Governance. Security is one of the major challenge for e-Governance because highly secure measures in e-Governance is only grow trust among people. Identification and authentication (I&A) is one of the security measure and Indian government worked on it. [4] In 2006 Indian government started organized initiatives for e-Governance and launched National e-Governance Plane [5] and this journey is going on and in 2014 government launched their ambitious project Digital India.[6] In 2012 government proposed e-Pramaan, a Framework for e- Authentication. [7] It is a guideline of authentication for e-Governance in India.

In this paper we study and analyze the authentication for e-Governance system. Second section of this paper explore the authentication systems of various developed and emerging countries. In next section, we explore and analyze the Indian e-Governance authentication framework i.e. e-Pramaan in terms of sensitivity, security with SWOT analysis.

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Then, we present a survey conducted on Indian administration involved in e-governance working to mine the requirements, feedback and acceptability of existing Indian e-Governance system. At last, we conclude the work with highlighting the major requirement of integrated, unified and multi-server based authentication protocol for e-Governance system for India.

II. STUDY & ANALYSIS OF E-PRAMAAN

Authentication framework is a technical structure to fulfil the requirements of the authentication. [8] Protecting the identity the actual user/server is the basic concepts of any authentication framework. Authentication is a basic necessity for any ICT based system as for e-Governance. This framework defines technical and organization hierarchy and standards. This also helps to manage various procedure in governance for creating, storing, validating and using the data associated with the particular ID of a citizen of any country. It will help with the reduction in cost of governance processing and improve quality and efficiency of delivery of government services.[9] For security and trust among the citizens, this framework should prevent illegitimate access and use of ID / authentication credentials. By this mechanism we will protect cyber terrorism, criminal activities, national security and other cybercrimes [10]. Various countries developed authentication framework for their e-Governance system for the sake of unauthorized access of the system. We hereby explore the authentication framework/ system/mechanism of various countries [11], [12], [13]

2.1. E-Pramaan (Introduction)

The e-Pramaan framework launched by Department of Electronics and Information Technology, Ministry of Communications & Information Technology, New Delhi on 2012 to enabled various government departments / agencies to address the access management and authorization requirements associated with the deployment of e-Governance applications and services. [14]

2.1.1. Highlights of e-Pramaan

In 2012, e-Authentication framework was launched for user authentication for e-Governance under NeGP (National e-Governance Plan). [15]

- The e-Pramaan framework enables various government departments and agencies to address the access, management and authorization requirements associated with the deployment of e-governance applications and services.
- It is used To define various types of authentication mechanisms and their usability in different scenarios that can be utilized by all government ministries, departments and agencies for electronically authenticating the users of government services.
- This proposed authentication scheme is classified into three kinds of authentication mechanism as:-
 - Single Factor Authentication: This authentication mechanism utilizes only one of the factors e.g., a user using username and password for accessing an application.
 - Two Factor Authentication: This authentication mechanism combines two factors e.g., a user using username and password as first factor and One Time Password (OTP) as the second factor for accessing an application.
 - Multi-factor Authentication: This authentication mechanism used two or more factors with one of the factors necessarily being the “Third Factor ‘Be’” which is something the user is, like, a user providing his/her AADHAAR number (first factor “Knowledge”) and his/her biometrics (third factor “Be”) for accessing an application.

- The strength of the credential types are related to the level of required assurance of a particular e-Governance service.
- This framework supports single sign-on mechanism to access various e- Governance services.
- In India, the e-Governance services are offered through three basic gate- ways as National Service Delivery Gateway (NSDG) [16], State Service De- livery Gateway (SSDG) [17] and Mobile Service Delivery Gateway (MSDG) [18], this authentication framework proposed interoperability of authentication to access various e-Governance services delivered by any gateway with single sign-on facility.
- This framework proposed authorization services along with authentication services.
- The authentication framework incorporates with one unique ID of the individual user called as UID based AADHAAR authentication process. [19]
- This mechanism helps in the authentication process with the use of ID / password and digital certificate of the user. [20]

2.1.2. E-Pramaan key components

The key components of e-Pramaan are as:-

Identity Management: This component was responsible for authentication and authorization, further ensure trusted and reliable online delivery of government services to the authenticated users.

E-Authentication: This is the process of verifying the identity of an entity which may be a person using a computer, mobile, program or the sys- tem(s) (computer, mobile, any service) itself.

Authorization: It is the process of verifying that a known person has the permissions and rights to perform a certain operations in an e-Governance application.

Credential Registration: It is the process which results in issuance of an e-Authentication credential, e.g. a password, a token, a digital certificate, or a biometric parameter), using which an identity can be electronically verified.

Permission Assignment: It is the process to provide the user access to on- line services, appropriate permissions need to be assigned to the user as part of the permission assignment process after issuance of the credentials.

Deregistration: It is the process of de-provisioning a user from a system. As the authority of individuals may change/update over time, a comprehensive deregistration process helps to manage these relationships accurately.

Single Sign-On : It is a specialized form of e-authentication that enables a user to authenticate once and gain access to the resources of multiple e-Governance services and applications.

2.2. Strength Weakness Opportunity Threat analysis of e-Pramaan

We analyze authentication framework 'e-Pramaan' in terms of SWOT as:-

Strengths: It is a first detailed framework proposed for authentication for e-Governance services in India.

- It is based on assurance level of e-Governance service and map credential type accordingly.
- Three kinds & 5 sensitivity levels of authentication mechanism are proposed in this framework
- In this framework, functionality of single sign-on and password management is incorporated.

- This framework is linked to the AADHAAR authentication process.
- This framework is decreasing the effort and cost of government departments/ministries and avoid duplication of authentication infrastructure.

Weaknesses

- There is no clear cut mechanism and authority, declared for registration.
- Data repository is not defined to store user data for registration.
- For user data, it is totally depend on AADHAAR process, which itself has various bottlenecks.
- For integration with AADHAAR authentication process (as proposed in DPR (Detailed Project Report) of e-Pramaan), it is required that all the government departments should incorporate AADHAAR with existing departmental records. It is a tough task to complete.
- There is no any government authority declared for issuing digital certificate for e-Pramaan.
- Security challenges to issue huge amounts of digital certificates for citizens of India.
- Integration of services/platform of various departments is a big challenge for authentication.
- Diversity and literacy is also a challenge for authentication.
- No any specific standardization present for authentication.

Opportunities

- In Digital India, the government declares the cloud repository, i.e. “e- Locker” to store important documents. It can be used as a common repository to store user credentials for authentication.
- In same project government declare to issue digital signature for citizens may resolve issues of certification in e-Pramaan
- Implementation of e-Pramaan will resolve the issue of access, interoperable and integrated e-Governance services.
- It is an opportunity to develop specific standards for authentication.
- More security functionalities should be incorporated in the existing frame- work.

Threats

- e-Pramaan may result in mass scale disillusion due to its implementation procedures and speed of implementation and, further may lose the lead to authentication for e-Governance and its appeal for the transformation of the public sector. • Several countries competing with India on the software front, and can take a strong lead in implementation in authentication solutions globally and capture the market share.
- Cyber-attacks are also a big threat for it.
- A big part of the population is illiterate and does not have awareness about the e-Governance and its applications, so, government will organize awareness sessions/programs about e-Governance and severity of e-Authentication.
- Success of e-Pramaan is based on success and acceptance of e-Governance of citizens.

III. E-GOVERNANCE SURVEY

3.1 Objective of Survey:- *The objective of our survey is to know about the performance, acceptability, trust, and problems in current e-Governance system. We tried to find answers of some questions as,*

whether the staff satisfies with current authentication. Will our proposed integrated authentication solution be beneficial for current e-Governance system of India? Will administration feel comfortable with this solution? Further, our objective is to know the version about our idea of authentication.

E-Pramaan framework described the authentication for e-Governance system as discussed in previous sections. On the basis of its analysis, we proposed an idea of a unified authentication system in which registration process is once and same for all e-Governance systems, citizen does not need to register again for other e-Governance systems because same authentication credentials will work for other projects. For this technique, there is no need of AADHAR registration and it is smart card enabled multi-server and ID-based cryptography technique for authentication.

3.2 Survey Methodology:- To identify the problems in the e-Governance system of India, we do a random survey of some districts of Uttar Pradesh (State of India with maximum population). We targeted the administrative staff of Uttar Pradesh from various departments and from all possible levels of a district. First, we conducted an awareness session about Indian e-Governance system/initiatives to all people from administration and then ask questions from our questioner (written). The districts covered in this survey are as:-

Table 1
Districts involved in this survey

<i>S.No.</i>	<i>Name of Districts</i>	<i>Sample Size</i>
1	Auriya	68
2	Banda	130
3	Chitrakoot	92
4	Etawah	86
5	Hamirpur	83
6	Kannauj	90
7	Kanpur	87
8	Mahoba	88
TOTAL	724	

3.3. Questioner of Survey

For any survey, the questioner is a tool to collect the response, mood and feedback from users/stakeholders to identify the actual requirement and problem of any system to make it better. For e-Governance, we prepared a questionnaire with six questions as:-

1. Question: E-governance makes life easy for Indian administration?
2. Question: Is the current environment of our country for e-governance (education, infrastructure, etc.) Appropriate?
3. Question: Is the Current Security level of e-governance satisfactory?
4. Question: Is user registration and authentication hectic and time consuming process?
5. Question: Every department collects the login/registration data from the user, should it be shared with other departments?
6. Question: In place of separate registration for each department, the combine and unified registration from any one department and use this data for all departments and application will be a good strategy?

IV. EXPERIMENT AND RESULTS

We conducted a survey over 724 officials of Uttar Pradesh from 8 districts. These administrative staff of government belongs to various departments and handle day by day, office work using an e-Governance system. These people get actual response and face problems of existing system, therefore we ask questions to these people from our questioner, to get root feedback of the system. After, got responses of this survey, we collected, digitized and analyzed these questions about it. Our objective is to identify the problem of existing e-Governance survey so that in future we will work on it to make system more effective and efficient e-Governance system for India. Every question is analyzed in the following sections as:-

1. Significance of question
2. Survey Results
3. Mean Value Analysis
4. Chi-square test

4.1. Significance of question

Question 1: This question asked to know about the impact on working of government officials. People always interested to resist the change due to their comfort. This question also addresses the acceptance of the changes of service delivery method from manual to information and communication technology (ICT) based e-Governance. Along with comfort, management and fast delivery of work, this question also addressed the response of citizens about e-Governance. Because, these government officials interact with citizens, who request for government services, if these people are satisfied and their number of complaints are lesser then of course this method of delivery is better.

Question 2: We asked this question to get feedback about the available infrastructure, awareness, training, contents, etc. for e-Governance. Through this question, we observed that, without awareness, education and proper training of e-Governance applications can't be popular and useful. The efforts of government like development and deployment of infrastructure, website and other framework for e-Governance will not give expected output without awareness, education and proper training of e-Governance. So, by this question, the mood of administration reflected about the available environment for e-governance.

Question 3: Security is the major concern for all available ICT projects specially the projects run on the internet. Because there are a lot of vulnerabilities present in the public channel of communication and information interchange. So this question is important to know the feedback on the security level of existing implemented e-Governance system of India. We would like to know the awareness and concerns of government officials for security of e-Governance.

Question 4: In existing e-Governance system, for each service/department, there exist separate web portals. So for each service, users required to register themselves for each service separately. For each service separate passwords, different OTP (One time Password), etc. have to be managed. Therefore, this process may be time consuming, hectic, vulnerable, and hazardous. So, the answers of this question, tell us what the officials views on this type of registration and authentication techniques

Question 5: Our hypothesis is about the integrated authentication system. So, through this question, we want to know that whether the officers of various different departments are willing to share the registration and user oriented data/information to each other? Do they feel comfortable with this sharing? Is there any ethical/ legal/technical issue with it or not? Because if we develop the integrated authentication system, then, it is required to share this information to each other.

Question 6: This is an important question for our future work. As we discussed we propose an idea of an integrated authentication system for e-Governance in India. In this we proposed single sign on or single

authentication system for all the e-Governance services. So for this, it is important to know about acceptance of this idea by the government officers. This question derives our work and give direction for our work.

4.2. Survey Results: The survey result recorded in tables as well as in bar graphs as given below.

**Table 2
Survey Result**

District	Yes		Can Not		No	
	(#)	(%)	(#)	(%)	(#)	(%)
<i>Question1</i>						
Auriya	65	95.59	3	4.41	0	0
Banda	115	88.46	13	10	2	1.54
Chitrakoot	80	86.96	9	9.78	3	3.26
Etawah	83	96.51	2	2.33	1	1.16
Hamirpur	74	89.16	5	6.02	4	4.82
Kannauj	87	96.67	2	2.22	1	1.11
Kanpur	81	93.1	4	4.6	2	2.3
Mahoba	83	94.32	2	2.27	3	3.41
Total	668	92.6	40	5.2	16	2.2
<i>Question2</i>						
Auriya	52	76.47	11	16.18	5	7.35
Banda	81	62.31	32	24.62	17	13.08
Chitrakoot	62	67.39	10	10.87	20	21.74
Etawah	67	77.91	10	11.63	9	10.47
Hamirpur	41	49.4	17	20.48	25	30.12
Kannauj	66	73.33	12	13.33	12	13.33
Kanpur	57	65.52	11	12.64	19	21.84
Mahoba	47	53.41	18	20.45	23	26.14
Total	473	65.72	121	16.28	130	18.01
<i>Question3</i>						
Auriya	42	61.76	15	22.06	11	16.18
Banda	66	50.77	49	37.69	15	11.54
Chitrakoot	51	55.43	19	20.65	22	23.91
Etawah	64	74.42	19	22.09	3	3.49
Hamirpur	38	45.78	32	38.55	13	15.66
Kannauj	54	60	22	24.44	14	15.56
Kanpur	40	45.98	41	47.13	6	6.9
Mahoba	32	36.36	33	37.5	23	26.14
Total	387	53.81	230	31.26	107	14.92

District	Yes		Can Not		No	
	(#)	(%)	(#)	(%)	(#)	(%)
<i>Question 4</i>						
Auriya	29	42.65	17	25	22	32.35
Banda	44	33.85	46	35.38	40	30.77
Chitrakoot	41	44.57	28	30.43	23	25
Etawah	52	60.47	20	23.26	14	16.28
Hamirpur	42	50.6	19	22.89	22	26.51
Kannauj	31	34.44	14	15.56	45	50
Kanpur	31	35.63	34	39.08	22	25.29
Mahoba	50	56.82	23	26.14	15	17.05
Total	320	44.88	201	27.22	203	27.91
<i>Question5</i>						
Auriya	55	80.88	7	10.29	6	8.82
Banda	99	76.15	25	19.23	6	4.62
Chitrakoot	74	80.43	14	15.22	4	4.35
Etawah	63	73.26	19	22.09	4	4.65
Hamirpur	71	85.54	7	8.43	5	6.02
Kannauj	70	77.78	7	7.78	13	14.44
Kanpur	66	75.86	16	18.39	5	5.75
Mahoba	77	87.5	5	5.68	6	6.82
Total	575	79.68	100	13.39	49	6.93
<i>Question6</i>						
Auriya	57	83.82	8	11.76	3	4.41
Banda	101	77.69	25	19.23	4	3.08
Chitrakoot	67	72.83	16	17.39	9	9.78
Etawah	71	82.56	9	10.47	6	6.98
Hamirpur	72	86.75	9	10.84	2	2.41
Kannauj	65	72.22	8	8.89	17	18.89
Kanpur	69	79.31	14	16.09	4	4.6
Mahoba	80	90.91	7	7.95	1	1.14
Total	582	80.76	96	12.83	46	6.41

4.3. Mean Value Analysis

Answers to our questions are in three ranges, i.e. either 'yes' or 'cannot say' or 'no'. Based on the means of the answers the verdict on this survey will be sketched. This is the basic tool to get results from the survey. There are 6 questions, and the below table 9 illustrated the mean values of each parameter of answers for each question. From the above table 9, the observations are drawn as:-

Answer to the first question reflects the message that 92.6% of people agreed that e-Governance is the need of the time. Government should deploy the e-Governance as much as possible. There is a very little

number who said 'Can't' and 'No'. Either they are not aware about the e-Governance or they are not willing to practice e-Governance in their offices. The number is so small and negligible.

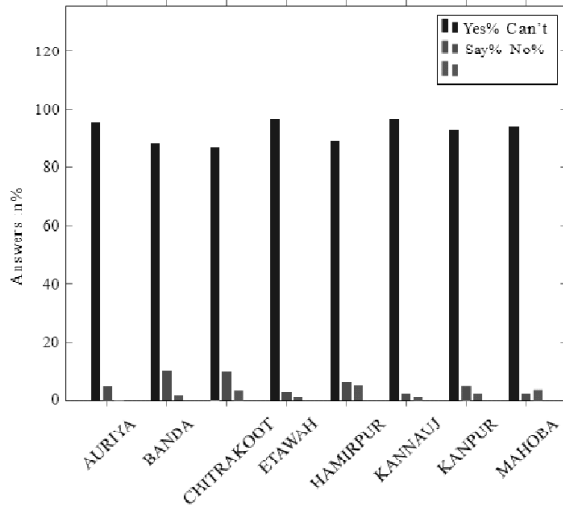


Figure 1. Survey result of question 1

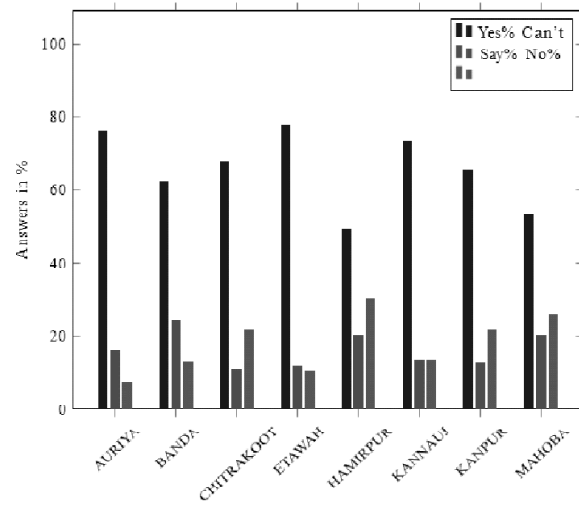


Figure 2. Survey result of question 2

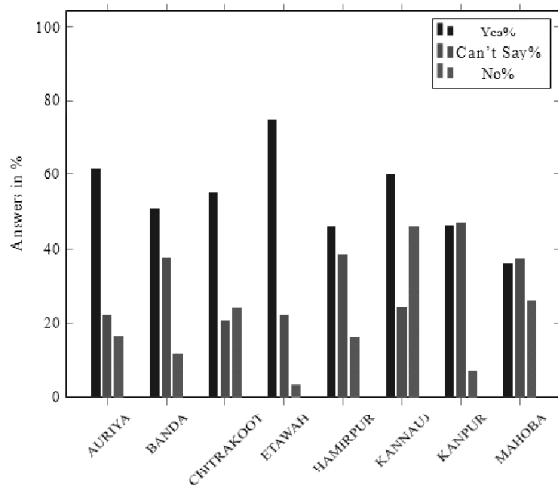


Figure 3. Survey result of question 3

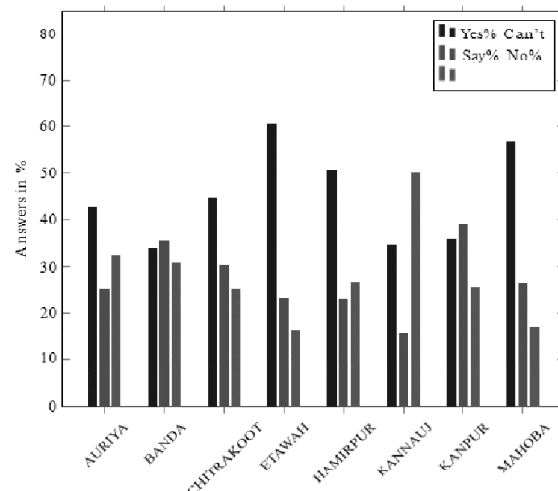


Figure 4. Survey result of question 4

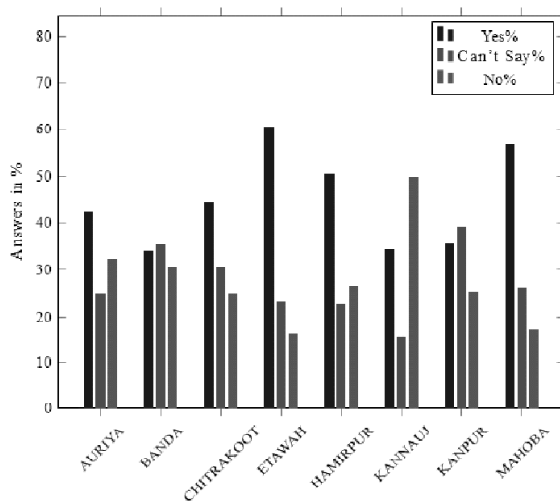


Figure 5. Survey result of question 5

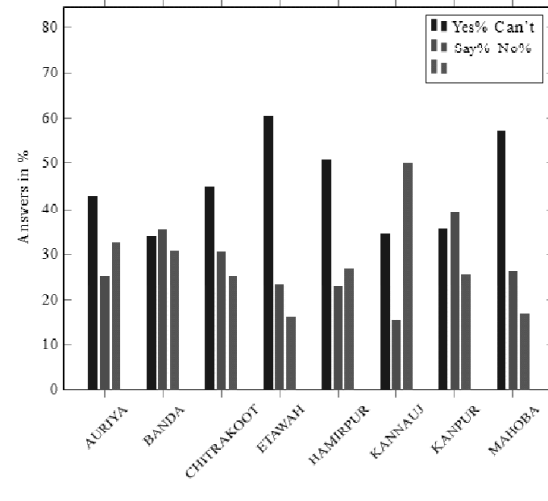


Figure 6. Survey result of question 6

Second question asked to know the perception and views of the administrative staff about the infrastructure/ training/education, etc. required and pre-requisite for any e-Governance project. 65.72% are saying 'yes' and satisfied with the existing infrastructure. But 18.01% people said, that are not satisfied with the available infrastructure. In the comment section of ours questioner, they all said that there is a requirement of better communication services (broadband) and hardware.

Third question asked to know about the security of the e-Governance system. 53.81% people are satisfied with the current security of e-Governance. But the rest of figures are interesting, 14.92% people are not satisfied with current security. They may find some flaws and vulnerabilities in the current system while 31.26% of people said 'can't say' means, they did not know the security and its impact on the e-governance system.

Next question asked to know about the authentication process. More than 50% may be the benchmark for any question, but answer of this question got below 50% i.e. 44.88% marks. It means the people are not satisfied with the existing authentication system and process for e-Governance. 27.22% people said that they can't say about it while 27.91% said they are unsatisfied with the existing authentication process/system.

Our idea is to share the authentication credentials with other departments. For this question, majority of offices and administrative staff (i.e. 79.68%) said that, they are not having any problem to share this data/information. While some of them, i.e. 6.93% raised doubt on this sharing and 13.39% are not in a situation to say anything.

Table 3
Mean value statistics of all survey questions

	Q1	Q2	Q3	Q4	Q5	Q6
Yes	92.6	65.72	53.81	44.88	79.68	80.76
Can't	5.2	16.28	31.26	27.22	13.39	12.83
No	2.2	18.01	14.92	27.91	6.93	6.41

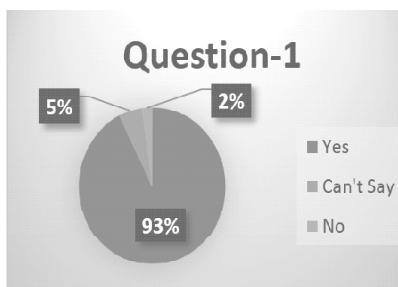


Figure 7. mean value of question 1

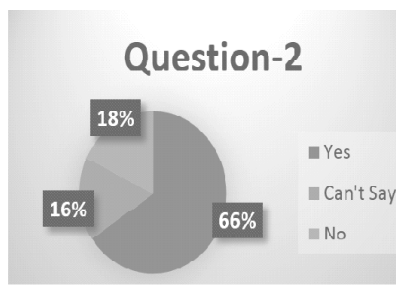


Figure 8. mean value of question 1

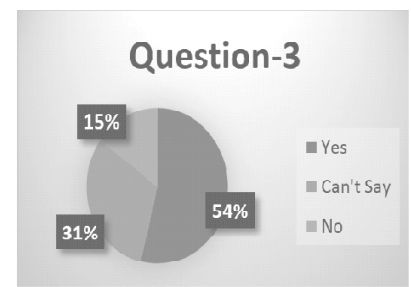


Figure 9. mean value of question 1

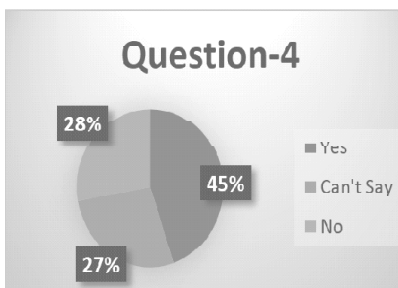


Figure 10. mean value of question 1

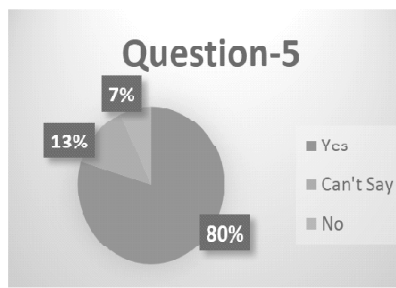


Figure 11. mean value of question 1

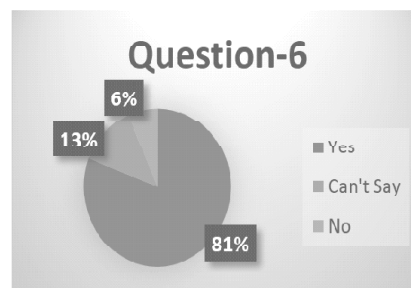


Figure 12. mean value of question 1

Our idea is accepted by the majority of people i.e. 80.76%. It means they got the feedback about the authentication and also felt that the current system of authentication is hectic and time consuming, therefore they are agreed to develop a new and integrated authentication process for any e-Governance service of India, whether it is national level. State level, integrated or local level. On the other end 6.41% people raised their doubt on this idea and 12.83% have said 'can't.' level. State level, integrated or local level. On the other end 6.41% people raised their doubt on this idea and 12.83% have said 'can't.'

The result is shown in below figure2. These pie charts show the verdict of government officials and also gave the direction to our future work. It is quite clear from the figure2 that there is a big and important requirement of integrated and unified authentication process for e-Governance system in India.

4.4 Chi-square (χ^2) Test Analysis

To test the significance of our survey, we test it by χ^2 test method. χ^2 test method can be used to determine if categorical data shows dependency or the two classifications are independent. It can also be used to make comparisons between theoretical populations and actual data when categories are used. This method is also used for a test of independence. It means χ^2 enables us, whether or not two attributes are associated. For instance, we may be interested in knowing whether a new medicine is effective in controlling fever or not, χ^2 helps us to decide these issues. For this analysis, we apply the following formula as: -

$$\chi^2 = \sum (O_{ij} - E_{ij})^2 / E_{ij} \quad (1)$$

Where, O_{ij} = Observed frequency of the cell in i^{th} row and j^{th} column.

E_{ij} = Expected frequency of the cell in i^{th} row and j^{th} column.

For our survey, the mean value of 'Yes' parameter is the expected value and actual mean of each district is observed values for analysis, Then we calculate the χ^2 value as shown in the table - 10 The degree of freedom is (n-1) where n is the total population. In our case there are 8 districts and therefore the degree of

Table 4
 χ^2 analysis data of all survey questions

Question	Test Values	Auria	Banda	Chitrakoot	Etawah	Hanirpur	Kannaauj	Kanpur	Mahoba	Final Value
1	O _i	95.6	88.5	87.0	96.5	89.2	96.7	93.1	94.3	1.14
	E _i	92.6								
	χ^2	0.1	0.19	0.34	0.17	0.13	0.18	0	0.03	
2	O _i	76.5	62.3	67.4	78.0	49.4	73.3	65.5	53.4	11.48
	E _i	65.72								
	χ^2	1.76	0.18	0.04	2.26	4.05	0.88	0	2.31	
3	O _i	61.8	50.8	55.4	74.4	45.8	60	46	36.3	17.99
	E _i	53.81								
	χ^2	1.17	0.17	0.05	7.89	1.2	0.71	1.14	5.66	
4	O _i	42.6	33.8	44.6	60.5	50.6	34.4	35.6	56.8	16.49
	E _i	44.88								
	χ^2	0.11	2.71	0	5.42	0.73	2.43	1.91	3.18	
5	O _i	80.9	76.1	80.4	73.3	85.5	77.8	75.9	87.5	2.14
	E _i	79.68								
	χ^2	0.02	0.16	0.01	0.52	0.43	0.05	0.18	0.77	
6	O _i	83.8	77.7	72.8	82.6	86.7	72.2	79.3	90.9	3.71
	E _i	80.76								
	χ^2	0.12	0.12	0.78	0.04	0.44	0.90	0.03	1.28	

freedom is (8-1) is 7. The below table- 11 give us results as our question number 1,2,5 and 6 are approved for 1% and 5% level, but question number 3 and 4 are accepted for 1% but rejected for 5% level. The below figure 13 represents the graphical view of the χ^2 -test of our survey. There are three questions, which gave the ideal results, those are 1, 5 and 6. While Question 3 was just meet the limit to accept for 1% level while rejected for 5% level. Similar results for question 4. While question 2 was just meet the limit for 5% level, but comfortable for 1% level.

V. CONCLUSION

India is emerging country in economics and by implementing the e-governance, a government willing to improve the current governance system. But there are a number of challenges in this field like population, diversity, infrastructure challenges, etc. But the biggest challenge for this existing system is authentication. In this paper we analyzed the authentication system of various countries, which already implemented e-Governance. In India we observed the perceptions and views of government employees about e-governance. All the government officials, who deal in e-governance are fully satisfied by the e-Governance initiatives. This is reflected in this survey. Another observation is about authentication. The Current authentication system of India is hectic and non-aligned. For each project, there is a separate authentication process. Which is not comfortable for administration as well as for citizens. This survey is pointing that government officials have not issue to share authentication credentials of citizens. It means they are ready to share the data and information about authentication. The last question is important of our survey, it is about the acceptance of novel, integrated and unified authentication system. In majority of government staff accepted this idea of authentication. For a huge country like India with huge government system and services, this survey gave us the direction to develop an integrated and unified authentication model/protocol to satisfy the need and requirement of government as well as the requirements of citizens which were reflected in this survey.

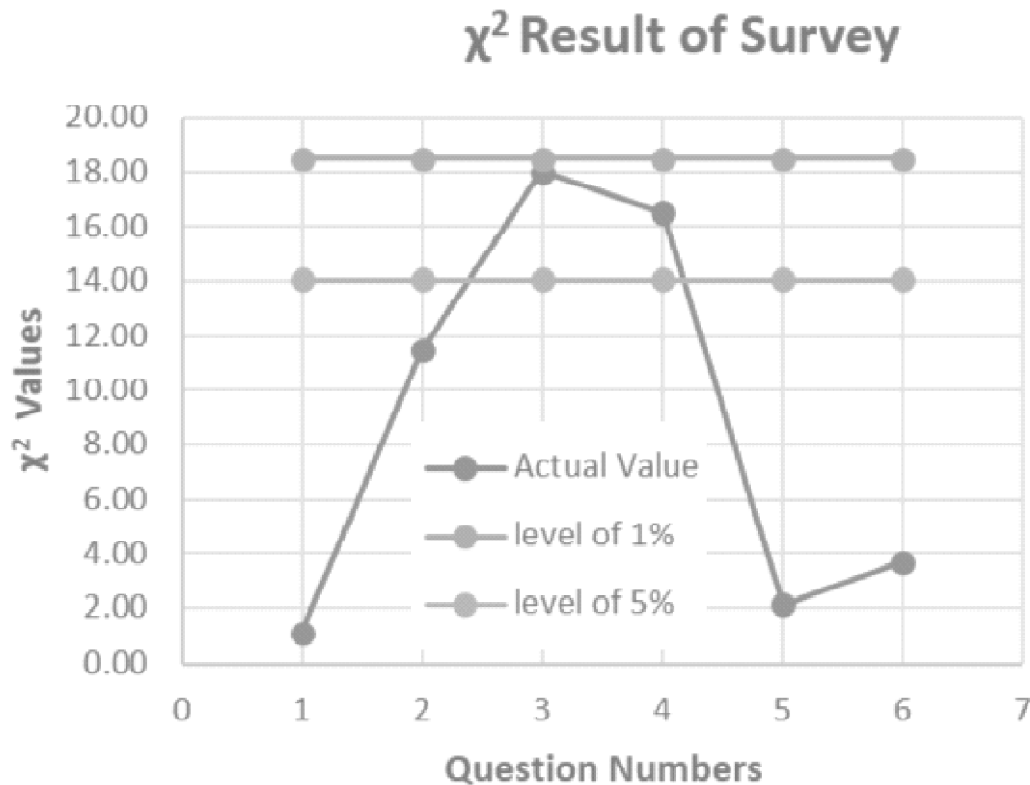


Figure 13: Graph to represent χ^2 -test

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