An Enhanced Authentication System using Multi-Level Security for web Services

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Abstract— With growing use of internet and its services, a large number of organizations are making use of password to provide security. A password is a secret word or combination of alphabet used for user authentication. Authentication to user account to access internet services on-line is achieved victimization password. The password is most convenient means of authentication. But now a day's password becomes hacked by the attacker. To provide more security, we are using Kerberos and the video CAPTCHA as authentication technique. Kerberos is a authentication protocol and CAPTCHA is a (Completely Automated Public Turing Test to tell Computer and Human Apart) test which provide a way to differentiate user into a human and malicious program. CAPTCHA become the most widely used standard security technique to prevent automated computer program attack. Our aim is to proposed a system which can be a better than existing CAPTCHA and provide higher level of authentication.

Keywords:CAPTCHA,Kerberos,videoCAPTCHA

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I. INTRODUCTION

Internet has become an indispensable part of daily transactions including shopping, education, Commerce and industrial sector. All these transactions mainly needs to enter individual information in certain registration forms and then only the user is allowed to access that website. But some individuals develop a program which makes false registration by filling wrong information and access the website. It results in the wastage of web resources. So in this way the malicious programmers or robots try to deny the services used by the regular users. There are various methods introduced to prevent these attacks. It is difficult for humans to examine the huge and bulky data of registration. Some methods are implemented with the help of computer in order to distinguish human users from computers. To distinguish between human and machine a test known as Turing test is used in which the right judgment is made by providing intelligence to computer.

First time CAPTCHA was invented in 2000 at Carnegie Mellon University by John Langford, Nicholas J. Hooper and Luis Von Ahn. CAPTCHA is an acronym for "Completely Automated Public Turning Test to tell Computers and Humans Apart" [2]. Completely Automated Public Turing test to tell Computers and Humans Apart (CAPTCHAs) are a class of automated challenges used to differentiate between legitimate human users and computer programs (`bots') on the internet. CAPTCHAs have many practical security applications, including preventing the abuse of online services such as free email providers. The need for a more secure yet user friendly CAPTCHA arises.

A CAPTCHA system must satisfy the following three characters:

1) Human can recognize the contents and pass it easily.
2) It is invoked to prevent robots to pass the system or to increase the processing cost through continuous attack.
3) It should be generated easily and quickly. CAPTCHAs have several applications for practical security,

CAPTCHA is an authentication process based on challenge response authentication. CAPTCHA provides a mechanism with the help of which a user's can protect them for spam and password decryption by taking a simple test. In this test a user will see either an image or a text which are normally distorted. The user is supposed to enter the pattern exactly as shown to him if the CAPTCH is based on text. If the CAPTCHA is based on image the user is supposed to enter the correct name of the image which correctly symbolizes the image. CAPTCHA is used where authenticated access is the primary concern.

It is widely accepted that a good CAPTCHA must be both robust and usable. The robustness of a CAPTCHA is its strength in resisting adversarial attacks, and this has attracted considerable attention in the research community. There are some properties defined for the development of CAPTCHA,

Automated: It must be possible for a machine to automatically generate and grade the challenges.

Open: The database(s) and algorithm(s) used to generate the challenges must be publicly available to ensure that the difficulty of the CAPTCHA stems from the underlying hard artificial intelligence problem and not a secret algorithm.

Usable: Humans must able to solve the test in reasonable amount of time. The effect of users language, physical location, education and perceptual abilities should be minimal. Challenges should be easily and quickly solved by humans.

Secure: The program generates the test should be difficult for machines to solve by using any algorithm. The underlying AI problem must be a well-known and well-studied problem where the best existing techniques are weaker than humans.

II. LITERATURE SURVEY

This section presents related literature concerning about Captcha system.

Bin B. Zhu, Jeff Yan, Guanbo Bao, Maowei Yang, and Ning Xu**,** suggest a new security is emerging as an exciting new paradigm, a novel family of graphical password systems built on top of CAPTCHA technology, which we call

CAPTCHA as graphical passwords (CaRP). CaRP is both a CAPTCHA and a graphical password scheme. CaRP addresses a number of security problems altogether. Notably, a CaRP password can be found only probabilistically by automatic online guessing attacks even if the password is in the search set. CaRP also offers a novel approach to address the well-known image hotspot problem in popular graphical password systems, such as PassPoints that often leads to weak password choices. CaRP offers reasonable security and usability and appears to fit well with some practical applications for improving online security**.** AnimalGrid and ClickText easier to use than PassPoints and a combination of text password and CAPTCHA. Both AnimalGrid and ClickText had better password memorability than the conventional text passwords. On the other hand, the usability of CaRP can be further improved by using images of different levels of difficulty based on the login history of the user and the machine used to log in [3].

With the growing use of Internet and its services, a large number of organizations are making use of it to provide and seek information of the people using those services. This has raised the chances of attacks on such services by interrupting them sending multiple requests to the servers providing these services programmatically. So a new technique that utilizes image from custom mouse cursors and outperforms some most popular CAPTCHA techniques such as Text – based CAPTCHAs and previous Image – based CAPTCHAs [4].

Baljit Singh Saini, Anju Bala, gives a CAPTCHA scheme that can be used to distinguish human and robot such as malicious program. Both Google and Microsoft use the text-based CAPTCHA for authenticated process. However, all text-based CAPTCHA has been broken due to the fact that it can't prevent Optical Character Recognition (OCR) attack which can automatically identify the CAPTCHA's words. Consequently, new kinds of CAPTCHA have been proposed to solve this security hole. For example, image-based and audio-based CAPTCHA are new emerging schemes used to replace text-based CAPTCHA. Here, they propose a novel CAPTCHA scheme (GeoCAPTCHA) which utilizes the personalized contents such as geographic information to prevent the 3rd Party Human Attack. Then, we conduct a security analysis of the usability and security of GeoCAPTCHA. GeoCAPTCHA can enhance the performance and security of the Google and Microsoft's CATPCHA system with rotated 3D street-view image [8].

As many text-based schema have been broken OCR techniques, a new 3D CAPTCHA have emerged. Here the study of robustness of 3D text-based CAPTCHA adopted by Ku6 which is a leading website providing videos in China and also provide the first analysis of 3D CAPTCHA. The security of this CAPTCHA scheme relies on a novel segmentation resistance mechanism, which combines Crowding Character Together (CCT) strategy and side surfaces which form the 3D visual effect of characters and lead to a promising usability even under strong overlapping between characters [1].

The prevailing implementation of CAPTHA is 2D still image verification code however; the developing AI and image recognition technology makes it possible for computer program to pass through CAPTCHA's test. So a new CAPTCHA implementation which is in the form of 3D animation based on the week point of computer vision. New method prevents attacks based on image recognition and moving object recognition [9].

III. PROPOSED SYSTEM

In a propose work, we are going to propose a system which provide a multi-level security to the web services. In a propose system we were using the authentication protocol i.e Kerberos and a video CAPTCHA which provide higher authentication and security to services. Kerberos is authentication protocol which work on the basis of ticket to allow nodes communicating over a network to prove their identity to one another in a secure manner. CAPTCHA is a turning test created by computer or program for user who is expected to be a human. The test is easy for human but difficult for any machine. The user is required to provide the correct response to the test and then user permit to access the work. When correct response is received then it conform that the response arrived from human and not from program or machine.

As our main area of discussion is to provide the security to web services for that we are using video CAPTCHA and Kerberos as standard authentication protocol. Our aim is to provide two way authentications to propose system one is with Video CAPTCHA and other is with Kerberos which uses a following algorithm.

```
L1:  un, pwd, t1-> request submission time.
     If un and pwd is matched with database
      Goto L2;
     Else
     Goto L1;
L2: t2-> login time,
     If t2 - t1< maxtime;
     Goto L3;
     Else
     Goto L1;
L3: Ticket,
     If Ticket is matched,
     Grant Access to services
     Else
    Goto L1;
```

In proposed algorithm there are three levels, in first level when user enters the user name and password in login process. When username and password is matched with the database then goto level two along with request submission time.In level two, t2 i.e. login time. When t2-t1 is less than the maxtime then goto next level. If t2-t1 is greater than goto level one.In level three, ticket is present to the user, in the ticket the username, user id , server id, and the time to live. If the contains of ticket is matched then ticket is used to access the services, otherwise it goto level one. Login time will be varying in each time.

IV. DESIGN METHODOLOGY

The architecture of system consists of the following sub-systems.

- Client registration with video CAPTCHA.
- Authentication ticket provided by server to client.

4.1 Client registration with video CAPTCHA

When user need to use the services then user required registering for services. In proposed system, we are using video CAPTCHA as a security mechanism which enhanced the existing security. As in existing system text based Captcha, image based Captcha, graphical Captcha. We are improving the security, in video CAPTCHA user need to enter the username, password, contact and email for signup process. In the signup process, user enters username, password and user clicked on the load video. Then video should be loaded, from loaded video frame are extracted and assign a tag and that tag is saved. At the time of login user need to enter the proper and exact tag. If the enter tag is matched then it process further towards services. If the entered tag is not matched then it goes to the login page and same process is repeated. Extracted frames may be in sequence or we can skip the frame and saved the tags. User had to set the three frame compulsorily, and if user want to set more frames then user can set the frame.

4.2 Authentication ticket provided by server to client

As we are going to provide a multi level security for web services. Firstly by using the video CAPTCHA and secondly by using the Kerberos which is based on the granting ticket to used the services. The working of the Kerberos is based on the ticket. Kerberos consist of ticket granting server which provide the ticket to user to used the services and the authentication server which authenticate the details of the user and also decrypt the the contain of the ticket. Kerberos consist of the key distribution center and the application server. Key distribution center consist of the ticket granting ticket and the authentication server. When user send request to authentication server to grant the ticket which is encrypted with the generated key and the key is formed by password. And then the user send this TGT encrypted with key to TGS to provide the ticket to used the services. Then reply is come with the ticket. Then user can decrypt using key and see the details of ticket which contains the user name, user id, server id, and time to live. Then user used this ticket and enters it if matched then user is able to use the services. Otherwise repeat the same process again.

1) 5. SIMULATION RESULTS

5.1 Security of Underlying Captcha

Security of captcha was calculated with the help of complexity of object. No theoretical model has been established yet. The complexity of object segmentation, C is exponentially dependent of the number M of objects contains in a challenge and potentially dependent of the size N of Captcha alphabet.

C=α^MP(N) where α>1 A Captcha Challenge challenge typically contains 6 to 10 character which is mostly used in text based Captcha, whereas a CaRP image typically contains 30 or more characters.

Time required to break the complexity of Click Text image is about α^30P(N) /α^10P(N)=α^20 times the complexity to break a Captcha challenge generated by CaRP.

In proposed work, we are using video Captcha and in that we are using 50 characters. So complexity of video Captcha is much harder to break than other Captcha α^40times harder to break than click- text Captcha and α^20 times harder to break text- based Captcha.

V. PERFORMANCE MEASURE

Our video CAPTCHA test makes use of the human psychology in recognizing events associated with video to distinguish between humans and automated computer programs, a task that is relatively easy for humans. The video were taken from a video database. The video should be presenting to the user, from that video frames are extracted and assign a tag to respective frame.

To effectively evaluate video CAPTCHA, we performed user studies among 25 users in the age range of 12-40, all familiar with computers and using Internet but have difference in years of internet use and frequency of internet use per day(hours).Table 5.1 listed some of the randomly selected participants or the users.

Participant's ID	Age	Year of internet use	Time
ID 1	25	6	26.41
ID5	19	4	27.86
ID 10	23	5	29.98
ID15	39	12	30.67
ID 23	14	1	33.45

Table 5.1: Randomly selected participants

Below figure shows the graphical representation of table 5.1. Graph shows that different user's are login. We record the age of user, year of internet use, and also time required to login. From this we can conclude that, if user is login and newly start the use of internet required more time. If user is of 60 plus then these people required more time to login. From this we can conclude that as age and year of internet used varies login time also varies.

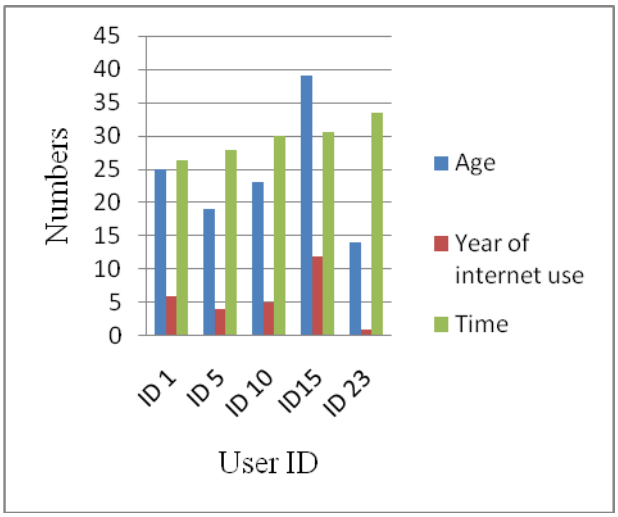

Figure 5.1: Graphical representation of table 5.1

At the time of signup process, users need to select video give tag to respective frame. The table 5.2 shows that, video, number of frames in video, time required to skip the frames and also time required to video.

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Video Number	Number of Frames	Time req. to skip frame	Time to load Video
Video 1	200	8.45	11.6
Video 2	240	9.53	15.88
Video 3	270	12.73	16.56
Video 4	290	13.34	23.13
Video 5	300	13.98	23.98
Video 6	320	14.16	24.47
Video 7	751	15.03	32.65

Table 5.2: Video Data

Below figure shows the graphical representation of table 5.2. The graphical representation shows the number of video's, time required to load the video, and number of frames in video. As video contains number of frames so time required loading the video depends on number of frame. Each video have different loading time. Time required to skip the frame also depend on number of frame. It is also different for different video.

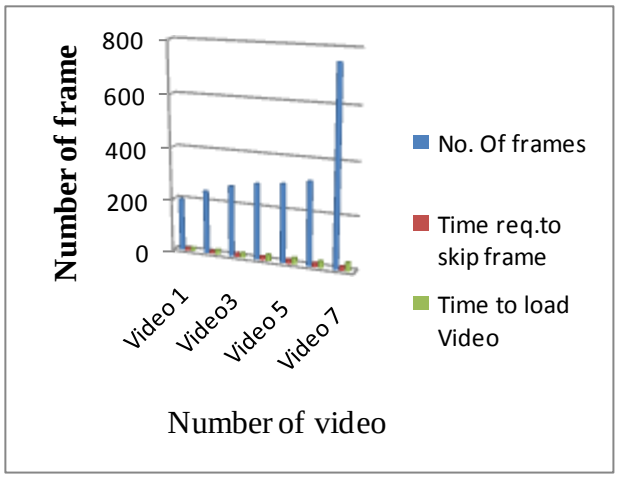

Figure 5.2: Graphical representation of table 5.2

The number of user, time required to sign up for different user in sec, time required to tagging the frames and also login time. Each user have different signup and login time. Depending on the video and frames in video and also in length of tag.

Below figure 5.3 Graph show the time in sec and number of user. Time is depending on the video which is selected by user, how many frames are skipped by user, and what is the length of tag. We take 10 user and they perform the signup and login process. Different user can select different video having different number of frames and skip multiple frames.

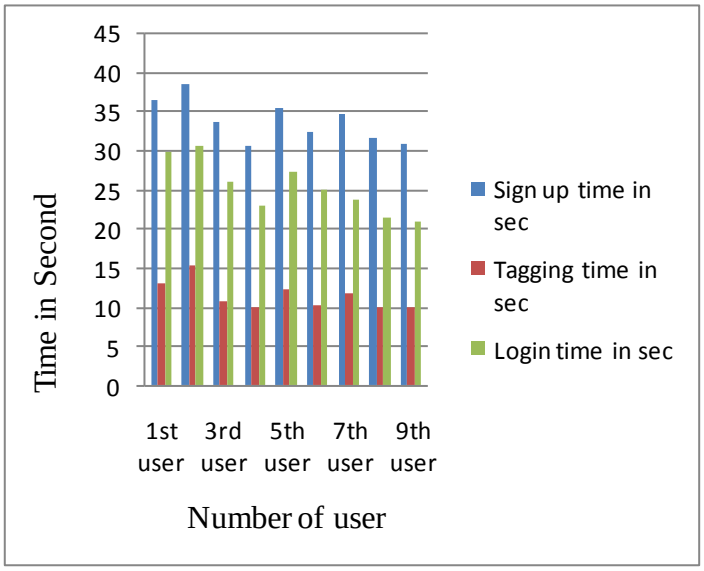

Figure 5.3 User information regarding registration.

Table 5.4 shows that when user register with video as a video Captcha. That time user select a video, in that video number of frames are there. So that user selects a video skip frames and record the time require for skipping one frame and respective time. Skipping time shows the time required to skip 1 frame. Now for example 1st user skip 5 frames from video so time required to skip one frame is 0.61. Skipping time of one frame is also depending on the number of frame in the video.

User	No. of Skip Frame	Skipping time	Time
1st user	5	0.61	14.18
2nd user	10	0.43	29.53
3rd user	15	0.24	23.45
4th user	20	0.2	15.07
5th user	30	0.22	15.087
6th user	50	0.11	20.087
7th user	75	0.08	24.45
8th user	100	0.06	32.34

Table 5.4: Skipping information

Below figure shows the graphical representation of table 5.4. The below graph shows that if user skip more number of then time required to skip one frame is less. And if user skips less number of frames then time required to skipping one frame little bit more. And also skipping time is depends on the number of frames in video.

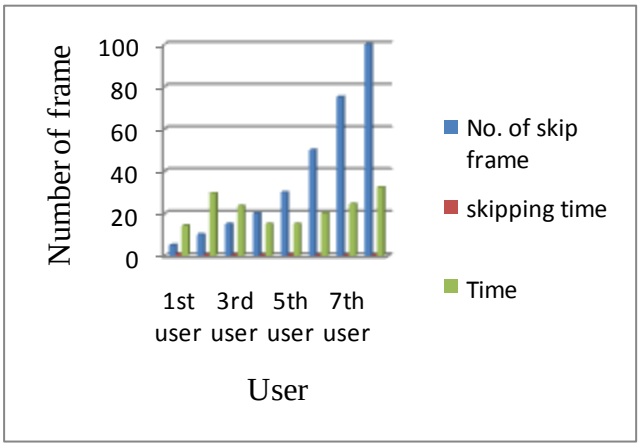

Figure 5.4: Graphical Representation of table 5.4

VI. CONCLUSION AND FUTURE WORK

Various CAPTCHA alternatives are continuously emerging, and this race will continue and more advance. The basic idea of CAPTCHA is to tell computer and machine apart and this concept is worth to be discovers for several reason. We have proposed the first CAPTCHA that uses video understanding to distinguish between humans and machines. As a contribution toward improving the web security in the field of an automated challenge and response against attacks issued by automated programs, we proposed a more robust video based CAPTCHA. Two main goals have been considered to be achieved that is: simplicity of solving the technique for a human as well as the time that a human actually needs to find the solution. Since a weak CAPTCHA implementation can only provide a false sense of security, we have been addressing the principle features which contribute in effective way to provide more secure challenge. We explore the security and usability of video CAPTCHA, and to propose a system which can be a better system than existing CAPTCHA and also provide higher level of authentication using Kerberos.

In future we will try to implement this in mobile with android operating system. The video CAPTCHA have more future scope where the quality of video should be improved, also video should be taken less memory space. We can use video CAPTCHA for providing authentication to cloud data. In future we can try to recognize frames by detecting computer vision attacks; content- based video retrieval attacks, and submit it.

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