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A New Security Mechanism for Graphical Password Authentication using Combo Captcha in Video Technology

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Abstract: ***CAPTCHA also known as Human Interaction Proof (HIP) is a system that has become a standard security mechanism for protecting web sites from web bots by generating tests that are solvable by humans and not by computers. As in today's web surfing captcha has become essential for the protection of web sites many different types of captcha have been introduced. In this paper we have proposed a new form of user authentication using captcha technology which is based on the imagination of human named" video based combocaptcha". The task for a user is to identify the image from the video which is a combination of two objects and uses that combocaptcha image as a password for authentication. We also described the various captcha techniques and the comparison between various captcha techniques.***

Keywords: Captcha; Human Interaction Proof; Bot; Turing Test; Combocaptcha; Denial of Service

1. Introduction

Internet has become the most dominant part in our life because of it's anytime and anywhere access to information and services. Some of our daily transaction services such as shopping, education, banking, etc...are offered by internet companies which provides a free registration process. The internet companies which provides a free registration process faces a major problem where various web bots sign up for thousands of free email accounts every minute and send out junk mails which may cause Denial of Service (DoS) attack [1].This attack slows down the internet service and reduces the availability of web service to the proper users. The web bots which are involved in this attack can be defended by a security mechanism called captcha.

A CAPTCHA [2] is an acronym for "Completely Automated Public Turing test to tell Computers and Humans Apart" and are used in some of the internet companies such as Microsoft, Google and Yahoo. Captcha which has its foundation in artificial intelligence and Turing test [3] is used to find whether the web service is used by humans or bots. CAPTCHAs are mostly rely on a visual test where the sophistication of computers is lacked behind the human beings when it comes to processing visual data. A common kind of CAPTCHA used on most websites is text captcha which requires the users to enter the string of characters that appear in a distorted form on the screen.

CAPTCHA are used because of the fact that it is difficult for the computers to extract the text from such a distorted image, whereas it is relatively easy for a human to understand the text hidden behind the distortions. Therefore, the correct response to a CAPTCHA challenge is used to decide whether it is a human or a bot. A robust captcha should possess two essential characteristics which are security and usability. Security provides protection against web bots and usability provides user friendly to humans. The other key properties of captcha are as follows:

1)They must user-friendly to humans
2)Correct solutions should only be attainable by solving the underlying AI problem they are based on.
3)The cost of answering challenges with automated programs should exceed that of soliciting humans to do the same task.

CAPTCHAs which are used in various web applications to identify whether the user is human/bot are given below

- Preventing Comment Spam in Blogs.
- Protecting Website Registration.
- Protecting Email Addresses.
- Prevention from Scrapers.
- Makes Online Shopping safe.
- **Online Polls-** Here captcha are used to prevent false votes and are used to efficient vote results.
- **Preventing Dictionary Attacks-** CAPTCHAs can also be used to prevent dictionary attacks in password systems.
- **Search Engine Bots-** It is sometimes desirable to keep Web Pages un-indexed to prevent others from finding them easily.
- **Preventing Worms and Spam-** CAPTCHAs also offer a plausible solution against email worms and spam.

2. Categories of Captcha

For the security of web service many different types of captcha[3] are introduced which are categorized as follows:

2.1 Text captcha

Text based captcha is the most widely used captchatechnique in which the user has to recognize the distorted alphabets/numerical values displayed in the image and type them. The important properties of text captcha are font, character set, distortion, waving, tilting. This type of captcha can be seen in Yahoo, Gmail, YouTube, PayPal and it is very simple to implement. The various implementation of text captcha's are as follows:

2.2 Gimpy

Gimpy is a very reliable text captcha built by CMU in collaboration with yahoo for their messenger service. It uses its words from dictionary and display them in distorted and overlapped manner. The task of the user is to type the words from the image and the response is used to verify whether the user is human/ bot.

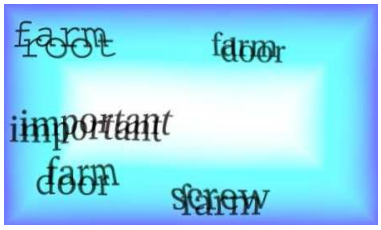


Figure 1.1 Gimpy CAPTCHA

2.3 Ez-Gimpy

Ez-gimpy is a simplified version of Gimpy captcha, adopted by yahoo in their signup page. It uses only single word from the dictionary and displays them in distorted manner. This type of captcha is easily defeated by OCR [4] and is not an effective technique.

Figure 1.2 Ez-Gimpy CAPTCHA

2.4 Baffle text

Baffle text captcha is a simpler version of gimpy captcha. It does not contain any dictionary words, but consists of random alphabets to create a pronounceable text. It overcomes the drawback of gimpy captcha by not using the dictionary words since clever bots can be designed to check the dictionary for the matching word by brute force [5].

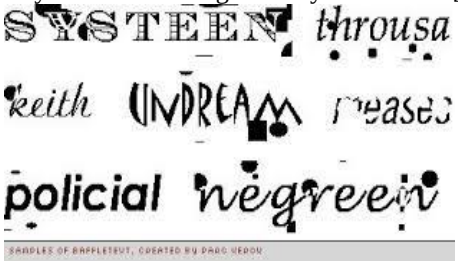


Figure1.3 Baffle text

2.5 MSN Captcha

Microsoft uses a different Captcha called MSN Passport Captcha's. This captcha uses only eight characters which may be either digits/alphabets and displays them in an image using foreground as dark blue and background as grey in color. In order to produce the ripple effect and to distort the characters, warping is used.

Figure1.4 MSN Captcha

2.6 Image captcha

Graphic CAPTCHAs are challenges that involve pictures or objects that have some sort of similarity that the users have to recognize. They are visual puzzles, similar to Mensa tests. These image based captcha are categorized as follows:

2.7 Vidoopcaptcha

Vidoopcaptcha is a verification solution that uses images of objects, animals, people or landscapes instead of distorted text. Each picture is associated with a letter which is embedded in it. In order to pass the challenge, the user is asked to report the letters corresponding to a list of required categories. It could differentiate the human from a computer.

Figure2.1vidoopCaptcha

2.8 Bongo captcha

Bongo captcha asks the user to solve a visual pattern recognition problem. It displays two series of blocks, the left and the right. The blocks in the left series differ from those in the right & the user must find the characteristic that sets them apart.

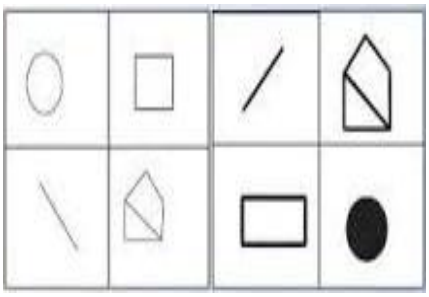


Figure2.2 Bongo CAPTCHA

2.9 Pix CAPTCHA

PIX captcha uses the image of large database of daily life object such as table, flower, cat, chair, etc… All set of images in the captcha which are shown to the user are related with the same concept of objects. The user has to enter the concept in which all objects of images are belongs to. For an example in the following Figureure all images are related to the object called "Elephant".

Figure 2.3 Pix CAPTCHA

2.10 Puzzle captcha

In puzzle captcha the user has to combine the segmented picture into one whole picture.

Figure 2.4 Puzzle captcha

3. Audio Captcha

Audio captcha [6] are based on the sound based system and contains the downloadable audio-clips. This captcha technique produces the words/numbers into the sound clip and distorts the sound clip. The user have to listen to the audio clips and type the spoken words. This captcha is produced for visually disabled people and is based on the ability of humans and computers in recognizing spoken language.

Figure 3: Audio captcha

4. Recaptcha

Recaptcha [7] is reliable, but some of the distorted word images are rather hard to solve. To get past that it allows you the option to "recaptcha", in order to receive a new one. There is also an audio option if you are unable to visually make out the word.

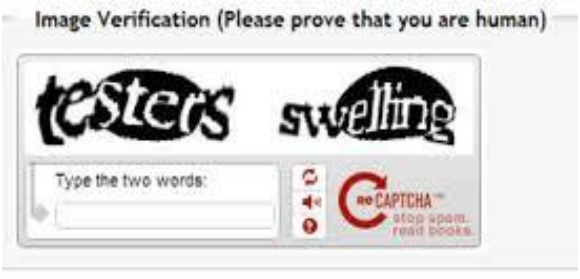


Figure 4: Recaptcha

5. Analysis of Video Related Captcha

A. Video captcha

The main aim of video captcha is to reduce the problem of text based captcha by providing more security to web service. Usually text captcha loss their security by OCR based attack, and video based captcha has been implemented in order to overcome this attack. It provides a security against OCR based attacks. One such video captcha which has been implemented is NuCaptcha [8]. In NuCaptcha instead of a static image a video will be displayed where a series of characters (codewords) moving across a dynamic scene will be displayed. The user has to solve the captcha by entering the correct codewords. The basic concept is that the bot are not able to cover these challenges within the video sequence whereas it will be easy for humans. One disadvantage of video captcha is that it takes more time to get loaded on a web page.

Figure A video CAPTCHA

B. Video understanding approach

Video understanding approach is also one of the recently developed captcha technique to reduce the text based attacks. In this understanding approach, three words (tags) are provided to the user which describes the video. If the user's generated tag equals the automatically generated ground truth tag then the test is considered as pass.

Figure B understanding approach video captcha

C. Combocaptcha - An Image Recognition Captcha technique

The term combocaptcha [9] is formed by two words combination and captcha. It consists of images that are merged by two animals, plants and other objects. Instead of text captcha a combocaptcha image will be displayed and the user have to identify by which images the corresponding combocaptcha is made and select the names from the list of images name given. After submit button is clicked if the correct names are selected it will proceed to further process otherwise another combocaptcha image will be displayed. From the survey of results, it is verified that the images are identified within three attempts. Therefore two chances are given to the user after that the service will be unavailable in order to protect unauthorized attack.

Screenshot 1: Clicking Options submit

Screenshot 2: Notifying the option wrong

Screenshot 3: User gets another chance

Screenshot 4: Successful Attempt of combocaptcha

6. Proposed Motion Based Combo Captcha Technique

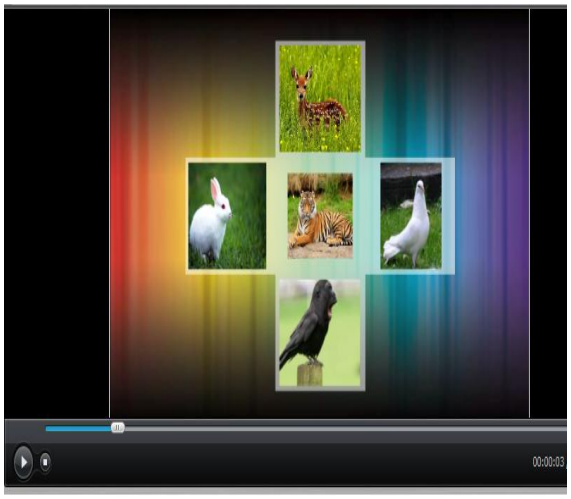
While text-based captcha has been the most popular form to date, motion-based captchas that provide some form of moving challenge have beenrecently proposed as the successor to static captchas.One such captcha that was already existing is NuCaptcha[8] where the users are shown a video with a series of characters (so-called random codewords) moving across a dynamic scene, and the user has to solve the captcha by entering the correct codewords.In this paper we propose a new video based captcha called combocaptcha which can be interactive because of itsinvolvement in the imagination of human. Video based combocaptcha uses movingimage object recognition (video) concept where the task of the user is to find the combocaptcha animal in the video and uses it as a graphical password for user authentication.

Usually the user who was trying to sign up their account in the free email service will be given a test before the user

gives the submit button.This test called captcha is used to find whether the user is human/bot.Instead of presenting it in static form we present it in motion-based captcha designs which can provide usability and security to the web service as well as to the human.

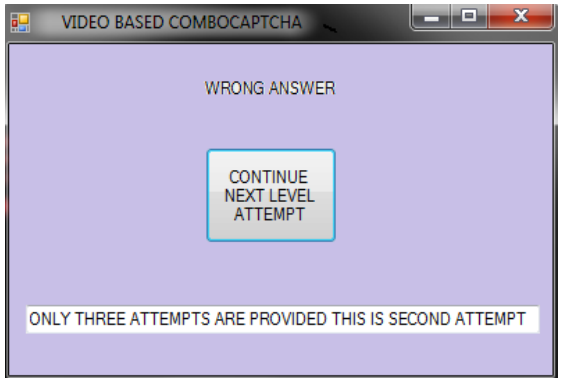
In our paper we propose an idea in which the user will be given a video which contain the images of the animals and a combocaptcha animal in-between the video before the user gives the submit button while registering an account in the free email service.Here the user have to visualize the video and recognize the combocaptcha animals and select the two correct options in the list of options given to them. When the user gives the submit button, if the correct options are selected it will get register otherwise a new video which contain another combocaptcha animal will be displayed where less effort to find the animals compared to the previous attempt is given .Until the correct option are selected the account won't be created for the user. When the correct options are selected the user must remember their Combocaptcha animal's name which will be used as password during their login process to the account. Only three attempts will be given to pass the test which is used to avoid the DoS attack and provide the web services to the legitimate user.

When the user login to their account, after the correct user name and password are given an image which contain the names of the animals will be displayed. In that the user have to select the correct names of their combocaptcha animal which was given to them at the time of registering their account. When the submit button is given if correct animal's name is selected it willbe moved to their account otherwise only two chances can be provided to select their password. If the correct names are not selected within two attempts it will block the service to avoid the usage by unauthorized user or bot program .The screenshot of our project are given below which shows the working process of the project at time of registering the account.

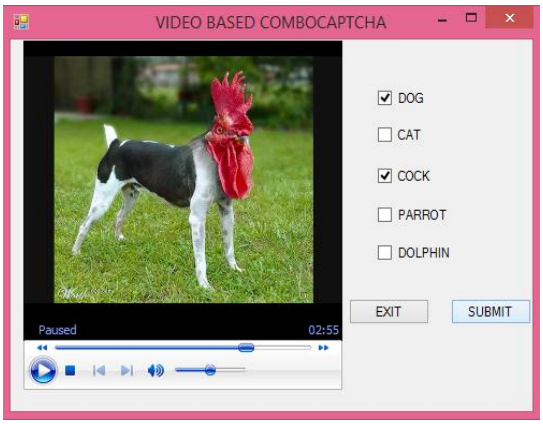


Screenshot 1 all images of a combocaptcha video

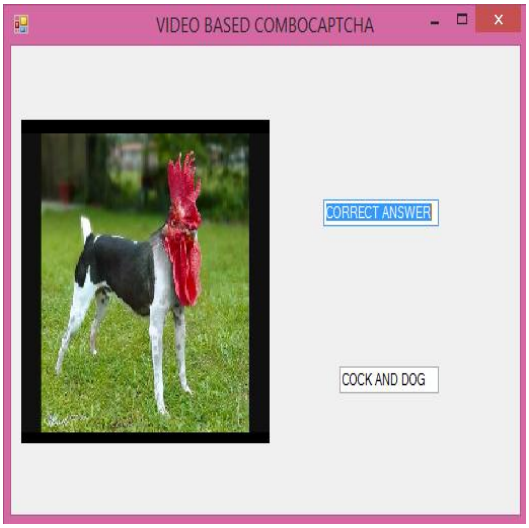
Screenshot 2 selecting wrong image names



Screenshot 3 Indicates that wrong option is selected



Screenshot 4 selecting the correct image names



Screenshot 5 successful attempt

7. Comparison of Various Captcha

Types of Captcha	*Security*	*Usability*	*Advantages*	*Disadvantages*
1.Text Based Captcha	Good	Average to use	Easy to implement.	User face some problem to identify the correct text and characters.it may have some multiple fonts,multiple size, and blurred letters.
2.Image Based Captcha	Good	Easy to use	Recognition of image is hard AI problem and therefore it is difficult to break this test using pattern recognition technique.	User face problem of image identification
3.Video Based Captcha	Good	Difficult to use	Difficult for bot to easily recognize.	Due large size of file user face problem to download the video and to find the correct captcha.
4.Audio Based Captcha	Good	Difficult to use	Useful for visually disabled people.	Audio is displayed in English so user have some problem in vocabulary.
5.Puzzle Based Captcha	Average	Difficult to use	It is interactive method.	This task is not easy for some users to arrange the puzzle
6.Combo Captcha	Good	Easy to use	Avoids monotonous text captcha.	User face the problem of identifying the correct combocaptcha image
7.Video Based Combo Captcha	Good	Easy to use	i)It is user-friendly and images are interesting to solve. (ii) Protects user account from unauthorized access.	Due large size of file user face problem to download the video.

8. Conclusion

This paper has laid out a technique which protects against the common attacks on the web service and provides the service to the legitimate user. Our proposed system which is a combination of recognition and recall method, serves as captcha as well as password for the user .It is highly usable as it is easy for humans to successfully provide the response. Video based combocaptcha overcomes the disadvantage of text captcha where the recognition of characters are difficult due to distortion.

This system is also language independent and many different types of images can be formed whereas in text based captcha only limited number of alphabets and numbers are available. Our video based combocaptcha system protects the user's account from an unauthorized user since the combocaptcha animal can be known only to the particular user. Thus it provides the high quality of security by preventing the system from a bot abuse.

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