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Animated Handwritten CAPTCHA based on 3D Effect

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Abstract— We all are familiar with internet and its uses and application. So we also must aware of its security and way of handling the websites. Many websites always ask us to perform some extra activity which is not needed to us in our work. Answer such problem is that they are crosschecking us whether we are real human or fake automated software program created by computer. Many persons create such unethical programs with the help of AI just to trouble server and jam the resources. CAPTCHA is a solution to that. CAPTCHA is nothing but the Completely Automated Public Turing test to tell Computers and Human Apart.. Simple CAPTCHA is easy to cracked, while complicated CAPTCHA is very difficult for the user to recognize. In this paper, I propose a new CAPTCHA implementation that is Animated Handwritten CAPTCHA based on 3D Effect.
Keywords- CAPTCHA, Handwritten CAPTCHA, OCR, H3AC, Computer vision, Artificial Intelligence

I. INTRODUCTION

Daily life has been radically developed with internet and the expansion of the world-wide-web (www). Now days it's essential to use internet so we also must aware of its security and way of handling the websites. But some malicious computer programs have attempted to attack on websites. Such as users are asked to fill registration forms by entering their personal details and request to perform specific tasks on the websites. Proper and authentic way is that registration should be done by genuine user that is human. However, registration can also be done by automated program which can even stop the running of the web site server. They perform this activity by filling a form automatically with wrong, fake information of person which may not exist in real and access through the web sites resources [3]. The hacking computer programs run dynamically so results in numbers of fake accounts creation which takes much more space to store. Solution to these types of problems is CAPTCHA. Hotmail and Yahoo, Google, Microsoft, many websites are used CAPTCHA in their websites. CAPTCHA providing a test as the final step of filling information process to stop bots from subscribing. CAPTCHA can be used for prevention of worms and spam, preventing comment spam in blogs, protecting website registration, preventing dictionary attacks, protecting email addresses, book digitization, search engine bots etc.
The typical CAPTCHA GUI consists of two parts: a character image with noise, and an input textbox.

Figure 1. CAPTCHA

The CAPTCHA system will ask the user to type the characters shown in the image. Image box warped with alphabets, numbers, characters in the image with s some sort of noise such as dots, dash, arcs or lines to confuse. The main idea behind this is that program may fill data sequentially with any information but any image is not accepted in CAPTCHA. CAPTCHA requires that perfect character which is shown in image box and this is only done by human user. However, the traditional simple CAPTCHA have been gradually facing the risk of being automatically recognized by computers, and

this may happen due to great achievement and improvement in the artificial intelligence (AI), image recognition. Complex CAPTCH cause much more difficulty for human users to recognize the words and takes so much time. So there is need which gives more percentage results to find computers and also not give overhead to human to solve. In this paper, I explore an Animated Handwritten CAPTCHA based on 3D Effect which generates such a powerful CAPTCHA that easy to understand by human and hard to break by computer. In second section I gather the related work which is previously done. In third section proposed system is explained and in fourth section proposed main algorithm. In fifth section discussion is done on end results with previous CAPTCHA and in six sections conclusion is made with future scope. In last section acknowledgement is given with references.

II. RELATED WORK

The first CAPTCHA was proposed by researchers at Carnegie Mellon University by Luis von Ahn, Manuel Blum, Nicholas Hopper and John Langford [3].
CAPTCHA is generally divided into following types according to their display.

2.1 Text CAPTCHA

In text based CAPTCHA computer uses a sequence of letters or numbers and distorts them with some amount of noise before showing them on the screen. Slight changes in text make vast variation in CAPTCHA as shown in Fig. We can use alphabets, numbers, non-alpha characters, different fonts, different size of font, its deformation and rotation etc.

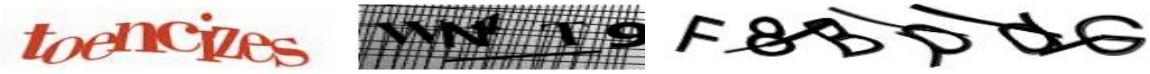

Figure 2. Text CAPTCHA

Limitations: - Simple CAPTCHA suffer several threats from the development of artificial intelligence technology and being cracked by any computer program [16]. Complicated CAPTCHA cause much more difficulty for human users to recognize the words, sometimes user has to type CAPTCHA more than 3-4 times which lead into wastage of time .Generally many audio texts CAPTCHA are difficult to understand due to background noise and distorted pronunciation.

2.2 Image Recognition CAPTCHA

Many have tried new experiment with photography or image recognition compare with other CAPTCHA. Microsoft has also researched in this type of CAPTCHA through its Asirra project [10]. Also CAPTCHA algorithm designed by Y.Rui is about recognition of human artificial face [2]. This CAPTCHA asks users to identify avatar faces from a set of 12 images which is of a mix of human and avatar faces. User has to select all Avatar (artificial) faces.

Figure 3. Image Recognition CAPTCHA

Figure 4. Avatar CAPTCHA

Limitations: - Image CAPTCHAs are not completely immune to bot attacks, but rising the computational time and costs can be very effective. Main disadvantage of this type of CAPTCHA is storage, near about 10 to 12 images are store in database for one CAPTCHA so it increases space

complexity. Its security is lost if its database is compromised, it requires more screen space than a regular text CAPTCHA. Again visually impaired users have no chance to solve this type of CAPTCHA, it doesn't improve usability.

2.3 Handwritten CAPTCHA

As mentioned in "Random Handwritten CAPTCHA: Web Security with a Difference" Paper by Mukta Rao and Nipur Singh this CAPTCHA is generated by hand drawn characters. It is one of the good methods [13].

Figure 5. Snapshot of Image Recognition CAPTCHA

Limitation:-If the database may hack there are chances of CAPTCHA cracking. Percentage rate of incorrect CAPTCHA recognition can be increased by using some new technique.
None of the solutions above meet all of the requirements that we expect for a perfect CAPTCHA.
Animated Handwritten CAPTCHA based on 3D Effect Characters offers challenges that are rarely encountered in machine printed Character.

III. DESIGN TECHNIQUES

Animated Handwritten CAPTCHA based on 3D Effect is based on some Techniques such as [12, 13].

- Animation
- Handwritten Characters
- 3D effect Characters
- Display Technique

Interesting simple GUI of CAPTCHA is shown to user. User can easily identify CAPTCHA image but at the same time computer program/software can not break this CAPTCHA. Steal constant image can be easily capture and crack by much of software but animated image hard to capture due its speed. So animation is one of the best tools which make this CAPTCHA dynamic means if any software wants to crack it, that software requires dynamic (run time) evaluation static calculations are not effective for such technique. Handwriting of each and every human is not same as bio terms differ. By taking samples of handwriting from some human alphabets are stored in database. These characters are used to generate CAPTCHA. The first step of difficulty makes for software to crack CAPTCHA. Even someone tried to develop advanced software using AI for braking of CAPTCHA; we make second hazards that add 3D effects in characters which show 3 dimensions height, width and depth. So again it is difficult to solve x, y, z, co-ordinates calculation. Using some techniques like frame difference method we can break animated CAPTCHA by some extend. So last and most effective method is show image box of CAPTCHA in limited size.

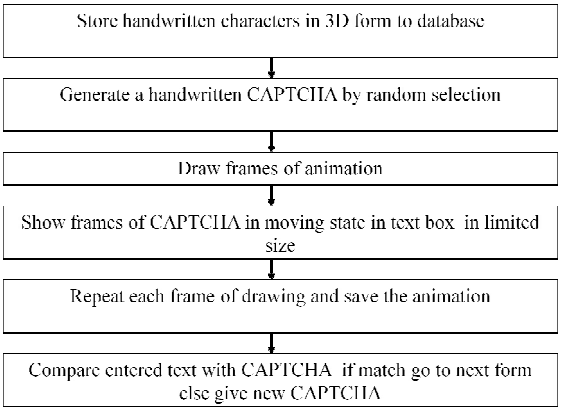

Figure 6. Flow chart of H3AC

Step 1:

So our set is { A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,Z}. Create hand drawn letters by graphics tablets with 3D effects drawn with 3rd parameter that is depth. Store such Handwritten CAPTCHA in 3D form into database. This stores height, width as well as depth of character according to the value of x, y and z coordinates. As mentioned earlier store image of each letters and give index name is also same. For A letter image index name is also A.

Step 2:

Generate CAPTCHA on screen by random selection. Apply random selection function on 26 letters and select any 6 letters. When we draw the first frame in the animation, we need to decide the total number of the moving objects in the frame, the initial position information of each object, and the showing attributes such as the color, the size and the shape of the moving objects. So by standard we have chosen 6 letters for CAPTCHA.

Figure 7. Sample of randomly selected CAPTCHA

Step 3:

Draw frames in given box so animation can be generated. Animated frames are differ to each other in aspect of size, font, scale, color, tilt, multimedia effects, noise distortion, background, contrast of color, intensity of pixels etc. For animation we have selected each letter as separate. 6 letters are not on the same frame. Continuous movement is shown in animation from left to right by translating object. For showing animation first character is separated by other with followed by white space.

Step 4:

Due to speed animation is created and CAPTCHA looks like moving. Show letters of CAPTCHA in moving state in text box but in limited size. So user unable to see whole CAPTCHA letters at a time. Out of 6 letters only 4 letters are visible on form. In rare cases you can see 5/6 letters but in cut format.

Figure 8. Sample of limited CAPTCHA

Step 5:

Moving CAPTCHA not seen as complete image to user at a time. So using AI cannot be capture the CAPTCHA, even it captures, the whole image is not recognized. So repeat each frame of drawing.

Step 6:

Compare entered text with CAPTCHA if match found also check all field are properly filled if yes go to next form else give new CAPTCHA or error msg.

IV. TEST RESULTS

Testing of any hypothesis/algorithm is a key step. It allows the user to check the correctness, usefulness and user-friendliness of the said technique.
The OCRs used to test the recognition CAPTCHA are freely available online OCRs and they are follows

- www.onlineocr.net referred as OCR-1[18]
- www.freeocr.com referred as OCR-2 [19]
- www.free-online-ocr.com referred as OCR-3 [20]
- www.newocr.com referred as OCR-4 [21]
- www.sciweavers.org/free-onlineocr referred as OCR-5 [22]

H3AC is compared with handwritten CAPTCHA.
The set of test samples have been conducted on 128 test samples and every sample has been tested with 5 OCRs hence in total 128x5=640 sample tests have been carried out online. The correct and incorrect recognition rate of these 5 types of OCRs is as follows [13]. As shown in tables H3AC gives very remarkable result with compare to previous system.

Table 1. Handwritten CAPTCHA Result

Online Tool → / Sample of CAPTCHA ↓	OCR-1	OCR-2	OCR-3	OCR-4	OCR-5
Correct Recognition	163	89	106	71	112
Incorrect Recognition	477	551	534	569	528
Percentage Of Incorrect Recognition	74.5	86.9	83.43	88.9	82.5

Table 2. H3AC Result

Online Tool → / Sample of CAPTCHA ↓	OCR-1	OCR-2	OCR-3	OCR-4	OCR-5
Correct Recognition	3	5	8	7	10
Incorrect Recognition	637	635	632	633	630
Percentage Of Incorrect Recognition	99.53	99.21	98.75	98.90	98.43

Table 3. Comparison of CAPTCHA Result

Online Tool → / Sample of CAPTCHA ↓	OCR-1	OCR-2	OCR-3	OCR-4	OCR-5
Correct Recognition	163/3	89/5	106/8	71/7	112/10
Incorrect Recognition	477/637	551/635	554/632	569/633	528/630
Percentage	74.5 /99.53	86.9 /99.21	83.43 /98.75	88.9/ 98.90	82.5/ 98.43

CONCLUSION

New method of CAPTCHA mechanism in the form of Animated Handwritten CAPTCHA is an effective random algorithm to produce handwritten CAPTCHA which are difficult for OCRs to recognize, while being very user friendly as made up of human handwritten letters. CAPTCHA letters are shown in animated form and not seen by user complete word at a time in frame to make it fun and convenient for users to solve them with less time with mark able result improvement about incorrect recognition.

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