



Mouse Dynamics based CAPTCHA: A Brief Review

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Abstract— *Emerging trends in CAPTCHA designing has introduced a new generation of mouse dynamics based CAPTCHA. Mouse dynamics based CAPTCHAs represent the rise of human friendly interface with time effective processing methods and robust security against bots. In this paper, we review such CAPTCHAs that use mouse dynamics for identifying human and bots apart.*

Keywords— *Completely Automatic Public Turing test to tell Computers and Humans Apart (CAPTCHA), Turing Test, Web Security, CAPTCHA as graphical Password (CaRP), Mouse Dynamics*

I. INTRODUCTION

CAPTCHA (Completely Automatic Public Turing Test to Tell Computer and Human Apart) is a Reverse Turing test used to prevent bot attacks on web. Various types of CAPTCHA designs were proposed with an aim to achieve robustness, quick processing time and ease of use for human being. Increasing use of internet has encouraged the evolution of CAPTCHA designs. Hence it has come to a milestone of mouse dynamics based CAPTCHA. Journey of CAPTCHA which started from text based challenge has now turned into a mouse interaction based challenge. This paper focuses on review of such mouse dynamics based CAPTCHA designs.

II. USABILITY OF MOUSE DYNAMICS

Mouse dynamics offers variety of ways to design CAPTCHA. It falls into the behavioural biometric authentication category. Mouse dynamics include following activities performed using a mouse:

- Mouse Movement
- Drag and drop
- Point and click

Click event can be further divided into single click and double click.

Although mouse event data can be mimicked by mouse event synthesisers, actual task to solve mouse dynamics based CAPTCHA always requires certain human level cognitive abilities as well. Thus mouse dynamics based CAPTCHA designs are far more difficult for bots.

III. LITERATURE REVIEW

A. Mouse Movement based CAPTCHA

Thomas et al proposed Cursor CAPTCHA which uses mouse movement and click event of mouse cursor for user authentication [1]. This CAPTCHA asks user to match the Custom Mouse Cursor by moving the mouse pointer and hover it over the challenge area where a matching image is found and click on that image without moving the mouse any further. This CAPTCHA achieves language independence, needs less storage and it is free from OCR attacks.

B. Drag and Drop CAPTCHAs

- 1) *DnD CAPTCHA*: It asks user to drag and drop correct alphabets or numbers in correct sequence [2]. It achieves intellectual and language independence by using this method. Fig 1. shows a sample DnD CAPTCHA.

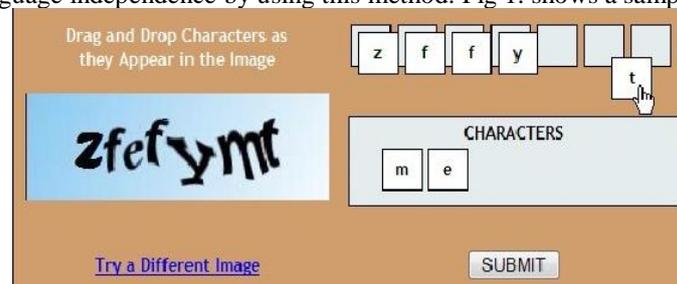


Fig1. DnD CAPTCHA

- 2) *sweetCAPTCHA*: This CAPTCHA involves dragging and dropping a specific image on another image [3]. It has comparatively more human friendly interface. Fig 2. shows a sample *sweetCAPTCHA*.

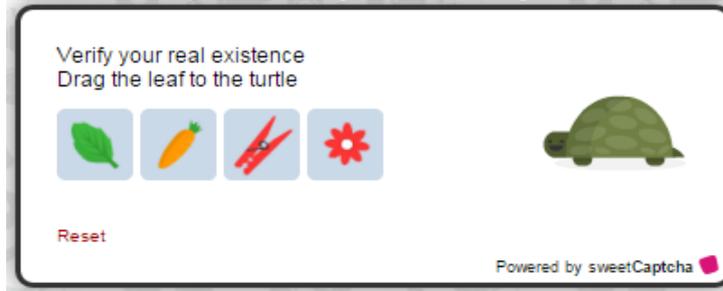


Fig2. *sweetCAPTCHA*

- 3) *DDIM CAPTCHA*: Drag-n-Drop Interactive Masking (DDIM) CAPTCHA generates a question by combining randomly selected letters and numbers [4]. Bottom candidate pool of letters is equipped with a masking achieved by overlapping other candidate letters. User has to find the candidate letters corresponding to the question string from the bottom candidate pool and drag and drop them to the answer area sequentially. Hiding technique used in this CAPTCHA increases its robustness. Fig 3. shows a screenshot of *DDIM CAPTCHA*.

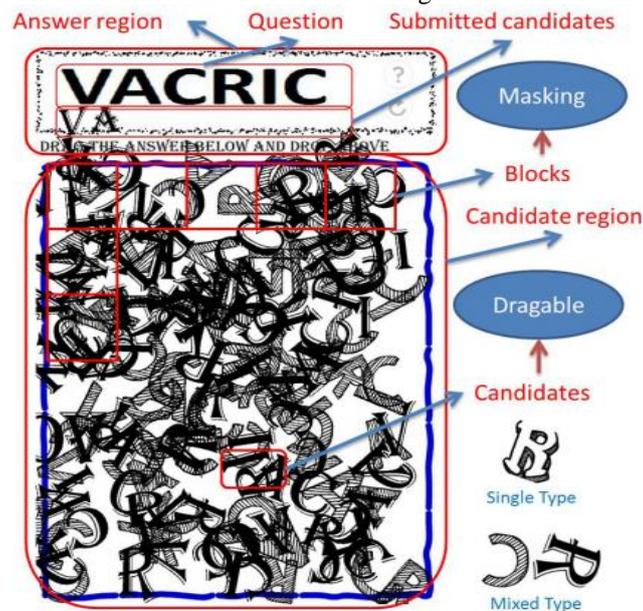


Fig3. *DDIM CAPTCHA*

C. Point and Click CAPTCHAs

- 1) *CaRP*: CAPTCHA as gRaphical Password (CaRP) is a new generation of CAPTCHA technology based on hard AI problems [5]. It is a click based graphical password system, where a sequence of clicks on an image is used to generate a password. This scheme is further categorized as recognition based and recognition-recall based CaRP. It provides protection against relay attacks and it is robust to shoulder-surfing .Fig4. shows a screenshot of CaRP.



Fig4. Screenshot of CaRP

- 2) *Extended CaRP*: This is recognition and recall based technique. It requires user to recreate a previously registered sequence of clicks on a grid [6]. This grid is created using multiple images. This provides higher security due to combination of multiple images and it is flexible for user preferences. Fig 5. shows a sample *Extended CaRP*.

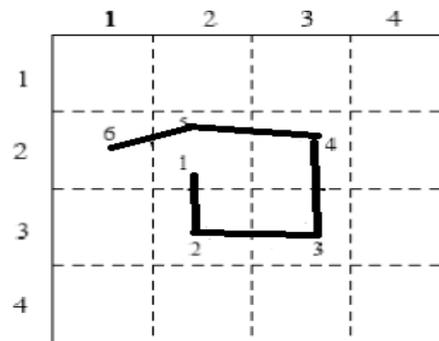


Fig5. Extended CaRP- Click based CAPTCHA

IV. CONCLUSION

Mouse dynamics based CAPTCHA schemes are latest trend in CAPTCHA designs. These mouse dynamics based CAPTCHA are able to repel relay attacks and robust to shoulder surfing attacks. As compared to the text based CAPTCHA and audio, video CAPTCHA; the mouse dynamics based CAPTCHA provide more human friendly interface which is equally difficult for bots. Thus above CAPTCHA techniques satisfy the basic requirement for a CAPTCHA design that it should be easy for human being and tough for bots. Hence mouse dynamics based CAPTCHA are promising area of CAPTCHA designing. It requires more efforts for continuous improvement in order to prevent bot attacks on web.

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