Audio Visual Reconciliation Intellectual CAPTCHA as New Era of Turing Test

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Abstract:

In this digital world; security is a significant concern towards access validation that can be computed through some kind of turing test i.e. CAPTCHA. The term CAPTCHA was introduced for classifying credibility of user whether the intervention has been initiated by human or bots. . CAPTCHA stands for "Completely Automated Public Turing test to tell Computers and Humans Apart". It is a fortification tool that denies junk/bots entries in the form of challenging problems. CAPTCHA has been prefabricated in various forms such as alphanumeric distorted strings, 3D strings, picture identifications, gaming problems and many more. The recent approach is gaming CAPTCHA and most of the game may increases the server load towards the browser. The logic behind the gaming CAPTCHA is dealing with dragging & dropping object to the target position, so these CAPTCHAs do not belong to the hard AI problems. The objective of the paper is to provide better level of hard AI problem that can be solved within few seconds with fewer efforts that challenges bots to solve in a limited time. But proposed CAPTCHA is based on audio video reconciliation where user has to recognize the correct combination of appearance with its sounds. That is why it contains two level security premises, speech recognition with picture identification.

Keywords: CAPTCHA, Web Security, Turing Test, Gaming CAPTCHA, Picture Recognition, Audio Video Reconciliation, Speech Recognition.

1. INTRODUCTION

The most common and traditional CAPTCHA is text based CAPTCHA where user is required to recognize distorted string as per the image shows, it may be alphanumeric, simply numeric or having alphabets only, fig.1.1 shows an example. CAPTCHAs are basically considered as case sensitive, so every user has to feed the exact case mentioned in the image. In today's era of excessive internet usage, a Turing test is required to oppose various attacks on websites [1].

Fig. 1.1: Conventional CAPTCHA [2]

So, CAPTCHA has been trolled up to bigger level where picture recognition, 3D, Math and Gaming CAPTCHA have been introduced. A game may be either drag and drop or click based. A game should be as easy as for human but almost impossible for bots. Gaming CAPTCHA is one of the highly secured CAPTCHAs used by web applications. Most of the gaming CAPTCHA are based on simple logics where user can solve it by dragging object to the target position and some are often difficult to solve even by a human due to the difficulty level. Gaming CAPTCHA saves the game log and send it to server for accepting or rejecting user. As in the fig 1.2, where user is required to drop the fishes in the target area i.e. ocean that would lead to solve the CAPTCHA.

Fig. 1.2: Gaming CAPTCHA [4]

2. RELATED WORKS

JingSong et al. [5] proposed a CAPTCHA that serves moving alphabets along with complicated background. Recognizing moving alphabets from 2-D image is not a big deal for human as well as for bots because video is a sequence of frames and frame does not possess any motion. That is why the complexity level of this system is not up to the mark and it can be cracked if a still image has been captured. Jing-Song et al. [6] emphasizes the weakness of 2D CAPTCHA which is often easier to recognized and machine based attack can affect it. Here system proposes 3D animation CAPTCHA where alphabets move over a complicated background which creates heavy confusion even for human. It is hard to recognize the correct string which may irritates human. Ibrahim et al. [7] proposed a system in which user will have to rotate the cube and identify the respective colors whereas marked with question marks. Once the user is able to rotate and identified the character mentioned over 3D cube, system allow user to get accessed otherwise a new problem will be served and color model will get changed and a new challenge proposes. Text box and 3D cube both have identical colors and user requires to match both the colors and recognize the correct letter and type over there for successful turing test. Aadhirai et al. [10] proposed a system which is based on vision where user will have to identify the object based on distance. System serves an image of real world where different kind of object relies where user is required to recognize the objects according to the distance from a particular object. There are hazy appearances in the image which leads to the difficulty level high and recognizing object w.r.t. the distance from 2-D image is also difficult. Song Gao et al. [11] proposed a security strand for gaming CAPTCHA such as relay attack that can affect the security of gaming CAPTCHA. These games are called Dynamic Cognitive Game (DCG) and the motive of this paper is to perform attacks over these games. Fig 2.1 shows how an attack has been trained offline for interaction with GUI. Author demonstrated various attacks over click based games, drag and drop based games and many more.
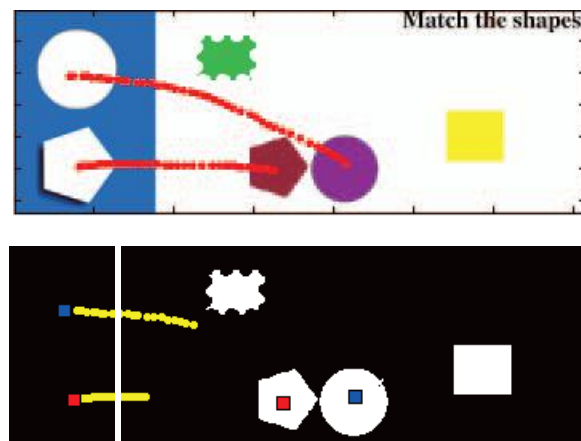

Fig 2.1: Hybrid Attack [11]

S. Ashok Kumar et al. [14] proposed a system which is based on mini games that have been designed using HTML5 and Java Script. These games are either based on clicks or drag. Fig 2.2 contains various birds with different colors and user is required to click only those birds that belong to yellow color. Color recognition is easiest thing in image processing to recognize with high level of accuracy.

Fig 2.2: Color Recognition based CAPTCHA [11]

3. PROBLEM IDENTIFICATION

By employing color detection algorithm, a color based target can be extracted easily with Image processing toolbox. These target objects either save coordinate values or layer's name, once the user performed a click over image then a

coordinate value saved as game log or forward it to the server for further processing. Here, color detection has been applied on previously proposed system that stated a problem of finding yellow colored birds. Using MATLAB, it is often easy to recognize yellow color and Fig 3.1 shows target extraction using color detection.
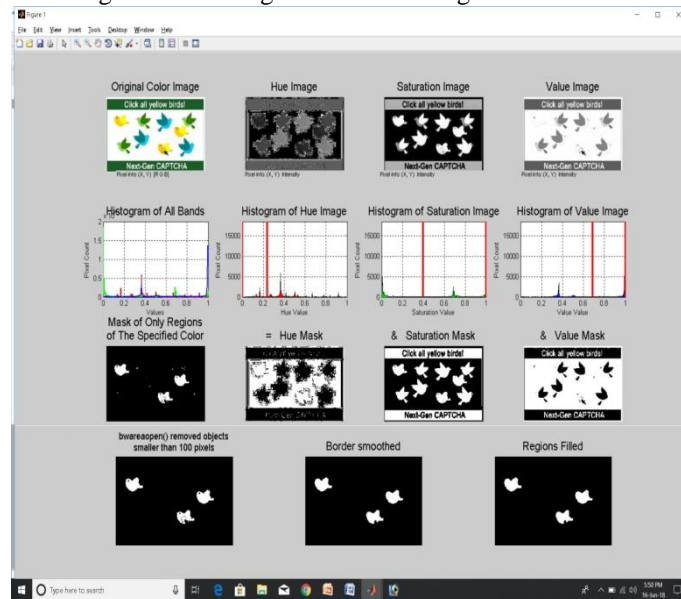

Fig. 3.1 Color based target acquisition

4. PROPOSED WORK

Here the system proposed a new level of CAPTCHA where user is required to recognize the correct object with a combination of speech and visual facts. This is called audio-video reconciliation CAPTCHA where two levels of AI problem have been interpreted. A CAPTCHA may contain various objects with different speeches associated with the same, user has to mouse over each objects and recognize the correct combination of audio-video match. User may obtain various correct visual with incorrect speeches but correct visual with correct audio is required to recognize for validating CAPTCHA in a given time.
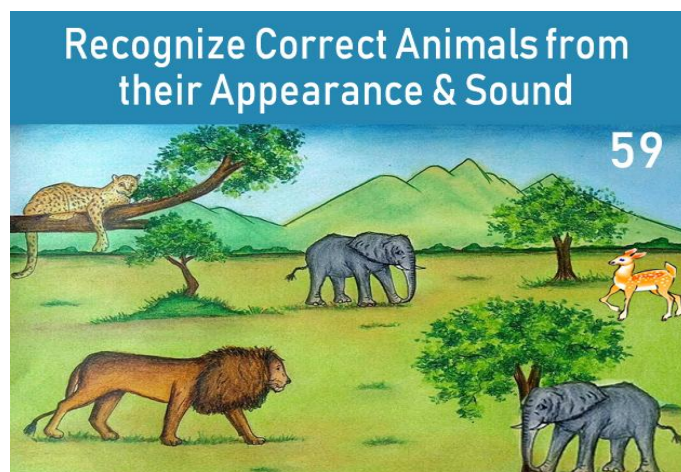

Fig. 4.1 Proposed Approach

User would have sufficient time for recognizing it but not more than one minute. One minute is sufficient for human being to crack without any problem but it is insufficient time for bots to crack it. Fig. 4.1 shows an example of proposed CAPTCHA where user is required to recognize all the animals that relate to the correct audio-video representation. Human tendency is often strong to recognize the speech at real time with high level of accuracy especially if it belongs to non-dictionary word as compare to the machine. Machine is not proficient well to recognize non-dictionary words such as animals sound, traffic noise and many more. Classification is bit lesser if it is intended by machine. But human can easily classifies the animal sounds as well as others.
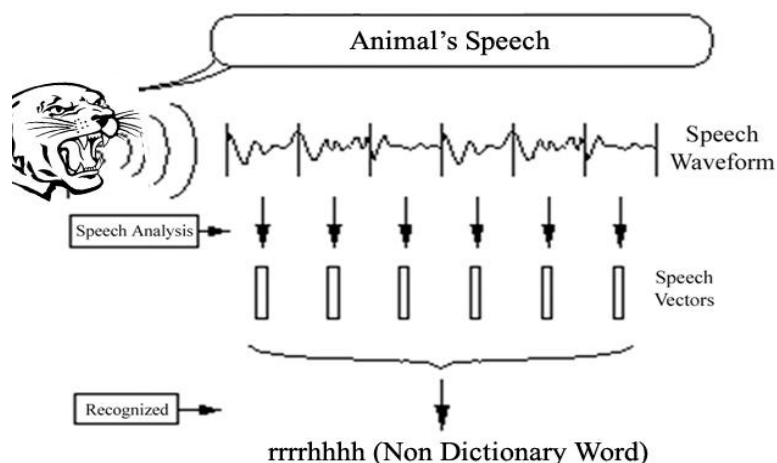
Fig. 4.2 Animal's Speech Analysis

Fig. 4.2 shows how a animal's speech forms a non dictionary word which is difficult to classify by machine but often easy for human. Even Hidden Markov Model may get confuses with different non-dictionary speeches, if it is challenges to recognize at real time. Proposed CAPTCHA will get expire after the time has been out and a new problem served if reload has been requested. Game theory has been used to construct interaction between human and game. Game theory is "the science of strategy," a branch of mathematics that studies the strategy, rules, and statistics of decision making games and applies it to other fields. The data gleaned from studying games can be related to back to economics, political science, social science, business in general , or even biology to better understand decision making and behavior in that field. The term "game" is in the title, but it is more a branch of complexity science than a study of games. The game is a kind of mathematical model to understand decision making and the interaction between decision makers. The best known game is the Prisoner's Dilemma. Two people are arrested, imprisoned and given a date for a trial.
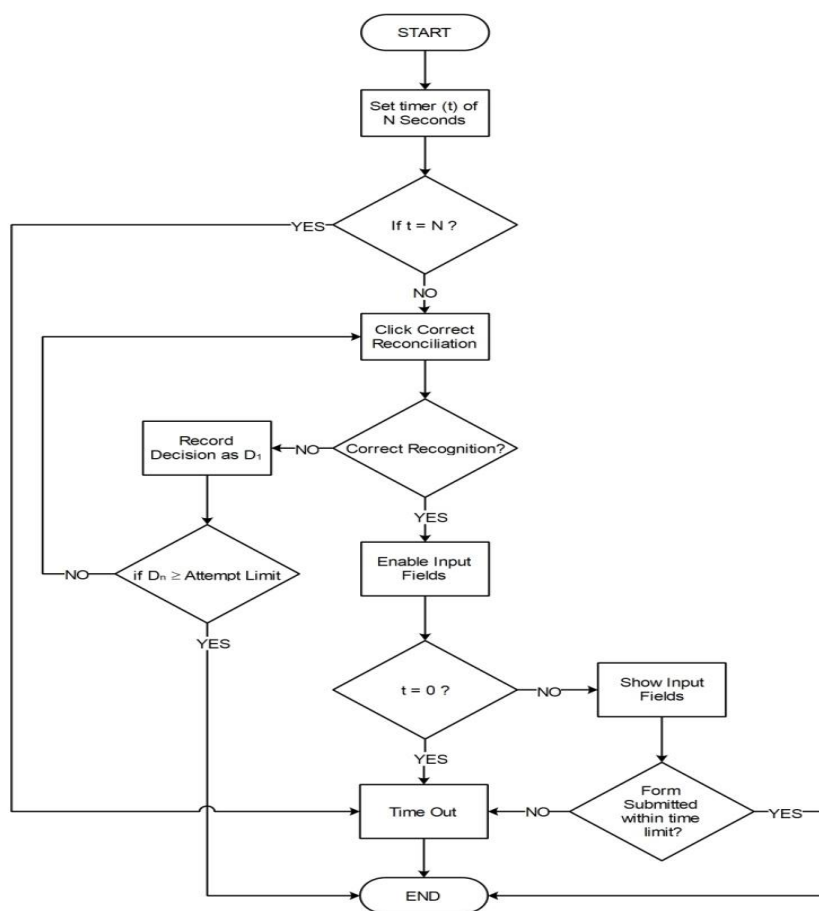

Fig. 4.3 Flow Chart

In the very first step, a timer is initiated and continuously validating with time limit. If time is out then it will end the process otherwise it will started verifying where correct reconciliation has been done or not, if it is a correct click then it will further check the time session and if it is made under that then input fields will get appear and user can submit form to the server. But if it is a wrong attempt then every wrong attempt will count and if it is greater than 3 then it will end the CAPTCHA as an unsuccessful attempt.

4.1 RGT (Reconciliation Game Theory) Algorithm -
Require: Total reconciliation object T_n, timer t, incorrect click O_i, correct click O_j, total incorrect clicks O_n, click c.

Input: Mouse Over || Mouse Click
Output: Correct Reconciliation

1: Steps ← 0
2: t ← 60 // Seconds
3: Click Objects ← True
4: //Check if incorrect reconciliation is clicked
   for all c ∈ entire layers **do**
     if O_i get clicked **then**
      Wrong Count ← i++
     end if
   end for
5: //Check if correct reconciliation is clicked
   for all c ∈ valid click **do**
     if O_j get clicked **then**
     Correct Count ← j++
      else
       repeat step 4;
      end else
     end if
   end for
6: **while** (t > 0) **do**
   if $O_i == O_n$ **then**
     Click.Enable ← false
     Verification Failed;
     else if $O_j == T_n$ **then**
      Input.Fields.Enable ← True
      t ← stop
      Submission ← Enabled
     end else if
   end if
  end while
7: End

As per the algorithm every wrong clicks will get recorded for future validation and if it is equal to the wrong attempt or wrong clicks limit then entire process will get terminated. Wrong click area covers the entire background along with all layers.

5. RESULT ANALYSIS

id	name	email	mobile	message	time_recorded	result
13	Bhartendu Tiwari	bhartend89@gmail.com	7888277533	This is Bhartendu Tiwari	10	Success
14	Udbhav Mittal	udbhavmittal15@gmail.com	9825478961	This is Udbhav Mittal	11	Success
15	Vaishali Singh	vaishali.cse@gmail.com	7474770632	This is Vaishali Singh	9	Success
16	Priyanka Gupta	priyanka0501@gmail.com	9329586123	This is Priyanka gupta	12	Success
17	-	-	-	-	-	Failed
18	Sachin Soni	sachinoist@gmail.com	9893314338	This is sachin soni	8	Success
19	Monika Agrawal	monikaagra12@gmail.com	9423564852	This is monika agarawal	13	Success
20	Keshav Kumar	keshavlnctcse@yahoo.co.in	7865423651	This is Keshav kumar	9	Success
21	Ruchita Chouksey	choukseyruchita89@gmail.com	8878061489	this is ruchita chouksey	10	Success
22	Anamika Singh	anamikabpl@gmail.com	9987475123	This is anamika singh	12	Success
23	Neha dangi	nehadangi.cse@gmail.com	8878659682	this is neha dangi	12	Failed
24	Manoj Tyagi	tyagi150@gmail.com	7069543211	this is manoj tyagi	11	Success
25	Anjali malakar	anjali.ntn@gmail.com	9755644581	This is anjali	13	Success
26	Rashika Motwani	motwanirashikamotwani@gmail.com	7703023655	this is rashika	9	Success
27	rohan rajput	rohanthegreat@gmail.com	9987403059	this is rohan rahput	11	Success
29	priya khandelwal	khandelwal51@gmail.com	6208759685	this is priya khandelwal	9	Success
30	Jaidev Kumar Bhagwat	jaidev150@gmail.com	8989487120	This is Jaidev Kumar	10	Success
31	Narendra Pathak	narendrakarate@gmail.com	9074154899	this is narendra	8	Success
32	swapnika gupta	swapnikasist29@rediffmail.com	7023586611	this is swapnika gupta	11	Success
33	ajay mehar	ajay.mehar.bpl@gmail.com	9977852210	this is ajay mehar	6	Success
34	sakshi pandey	sakshipandey1221@yahoo.com	8878061992	this is Sakshi Pandey	7	Success
35	rohit shakya	rohitshakyasam@gmail.com	8230256892	this is rohit shakya	13	Success
36	rahit sahu	rohit.ncc.jbp@gmail.com	9179875520	this is rohit	11	Success
37	Dashrath Mahto	mahto.cse11@gmail.com	9987522655	this is dashrath mahto	9	Success
38	shivali pandey	shivalipandey1992@gmail,com	9329635986	this is shivali	12	Success
39	Aashish Sahu	bistashish2010@gmail.com	9755858522	This is Aashish Sahu	10	Success
40	Sakshi Saxena	sakshi.saxena@gmail.com	7025253206	this is sakshi saxena	11	Success
41	rushak tiwari	tiwari0202@gmail.com	9424245856	this is rushak	13	Success
42	vivek kumar	vivek.cse@gmail.com	9921365894	this is vivek	11	Success
43	Neha Singh Bais	nehasinghbaisbhopal@gmail.com	9425568597	this is neha bais	13	Success

Fig. 5.1 Result Simulation

Fig. 5.1 shows the simulation of data records and data collection over 30 participants. It records their personal data along with time duration for completing or solving CAPTCHA successfully. There is one failure because of wrong attempts that feasibly possible for bots not for human. The success rate is bit higher than the previous method.

Table No. 5.1 Data Records and Collection

Sr. No.	User	Time Recorded	Result
13	Bhartendu Tiwari	10	Success
14	Udbhav Mittal	11	Success
15	Vaishali Singh	9	Success
16	Priyanka Gupta	12	Success
17	-	-	Failed
18	Sachin Soni	8	Success
19	Monika Agrawal	13	Success
20	Keshav Kumar	9	Success
21	Ruchita Chouksey	10	Success
22	Anamika Singh	12	Success
23	Neha dangi	12	Failed
24	Manoj Tyagi	11	Success
25	Anjali malakar	13	Success
26	Rashika Motwani	9	Success
27	rohan rajput	11	Success
29	priya khandelwal	9	Success
30	Jaidev Kumar Bhagwat	10	Success

31	Narendra Pathak	8	Success
32	swapnika gupta	11	Success
33	ajay mehar	6	Success
34	sakshi pandey	7	Success
35	rohit shakya	13	Success
36	rahit sahu	11	Success
37	Dashrath Mahto	9	Success
38	shivali pandey	12	Success
39	Aashish Sahu	10	Success
40	Sakshi Saxena	11	Success
41	rushak tiwari	13	Success
42	vivek kumar	11	Success
43	Neha Singh Bais	13	Success

$$\sigma = \sqrt{\frac{\sum f(x - \hat{x})^2}{\sum f}}$$

$\sigma - Standard\ Deviation$
$\sigma^2 - Variance$
$\mu - Mean$
$Min - Minimum\ time\ recorded$
$Max - Maximum\ time\ recorded$

Table No. 5.2 Result Comparison

Terms	S. Ashok [14]	Proposed
No. of Participants	30	30
Min	2.9	6
Max	5.2	13
μ	4.33	10.48
σ	0.79	1.84
σ^2	0.63	3.42
Success Rate	93.7	96.67

Here the previously proposed system is get affected by color detection tool. If system fails or get cracked the then feasibility of system has been destroyed and the result obtained on the basis of that cannot be feasibly examined. Color detection is not applicable for proposed CAPTCHA instead of that user requires visual and audio intellectuality. As per the hard AI problem that proposes for better machine tests, the minimum time required should lies between 5 to 8 seconds and maximum between 9 to 15 seconds. But if system takes more than 15 seconds then success rate affected that may irritates human.

Graph 5.1 Proposed Completion Time Recorded
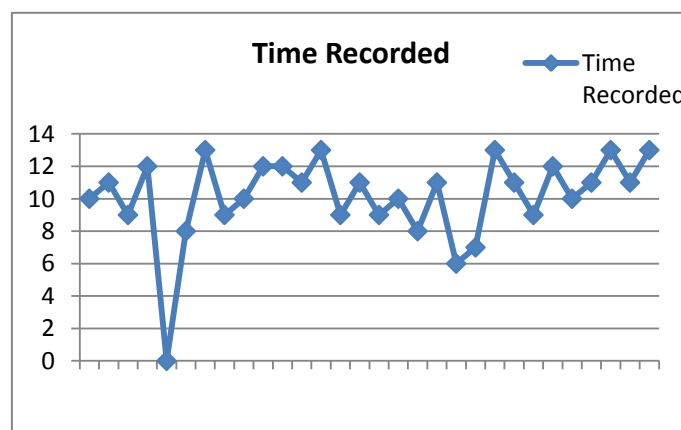
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