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Decisive Gaming CAPTCHA using Game Theory

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Abstract*— In this advanced period, web security is frequently expected to be careful from fraudulent activities. There are a few programmers who attempt to fabricate a program that can communicate with site pages automatically and attempt to break the information or make a few garbage passages because of that web servers get hanged. To stop the garbage passages; CAPTCHA is an answer through which bots can be distinguished and denied the machine-based program to intercede with. CAPTCHA stands for Completely Automated Public Turing test to tell Computers and Humans Apart. In the movement of CAPTCHA; there are a few techniques accessible, for example, distorted text, picture recognition, math solving, and gaming-based CAPTCHA. Game-based Turing test is a lot well known now daily however there are a few strategies through which the game can be broken on the grounds that game isn't intellectual. In this way, there is an expected characteristic of CAPTCHA. The proposed framework depends on the Intrinsic Decision-based Situation Reaction Challenge. The proposed framework can more readily characterize the humans and bots by its inborn issue. It has been considered as a human is fit to manage the genuine issues and machine is bit poor to understand what is happening or the way that the issue can be settled. Thus, proposed framework challenges with basic circumstances which is simpler for human yet extremely difficult for bots. Human is expected to utilize his presence of mind just and the issue can be addressed with few moments.

Keywords*— CAPTCHA, Web Security, Turing Test, Reaction Test, Game Theory, Hard AI Problem, Bots.

I. INTRODUCTION

In the field of web security, CAPTCHA assumes a significant part since it has not been revelled with accommodation structure then programmer can constructed a program that automatically presents a few phony sections and consumes the data set and server becomes inaccessible for different clients. Along these lines, it required putting with accommodation structure and it is likewise expected to utilize high security based CAPTCHA. Programmers can make the valid server occupied and by the assistance of SEO (Search Engine Optimization) a phony or faker site can be served through which real clients get confounded and they put their data in off-base spot [1].

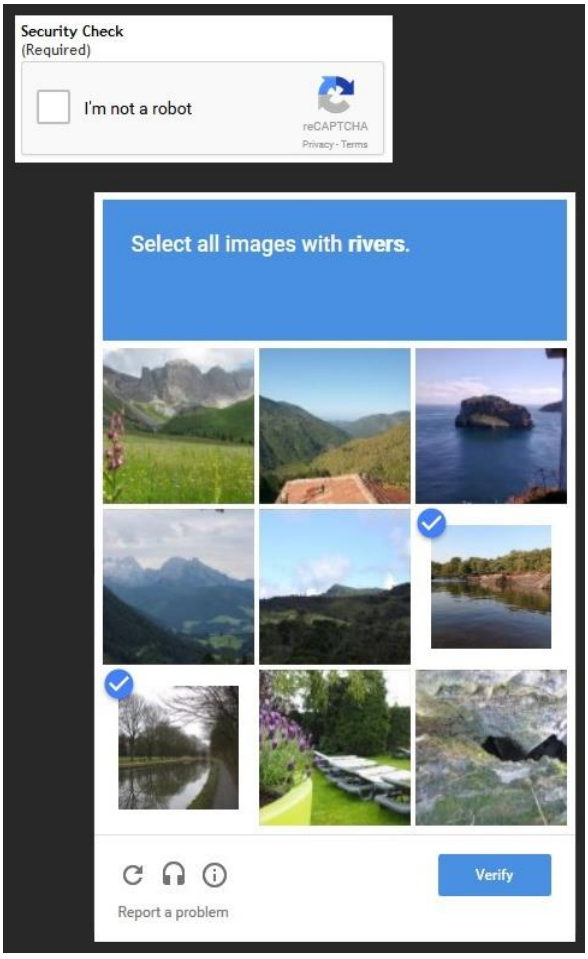

Fig. 1. Picture Recognition CAPTCHA [2]

Fig 1 shows the picture recognition challenge where client is expected to perceive those pictures that contains sculptures. Thus, according to the fig 1; it is extremely confounding to perceive every one of the sculptures and according to the best CAPTCHA; it ought to be all around as simpler as feasible for human and exceedingly difficult for bots. Picture recognition challenge is simpler assuming that item is more apparent however harder assuming article is bit converged with foundation data. To make the test more intractive, gaming CAPTCHA is bit polular that can employ the attension of clients. Gaming CAPTCHA is a sort of small games where client is expected to connect with something similar. There are a few method of gaming CAPTCHA accessible, for example, click based, drag and drop based, composing based and some more.

Fig. 2. Gaming CAPTCHA [3]

II. Related Works

There are different explores which have been finished in the field of web security where different philosophies have been utilized for accomplishing better security model. Ahmet Faruk Çakmak et.al. [4] proposed a sound CAPTCHA utilizing Support Vector Machine (SVM). In this sort of challenge, there are a few sound records are related with specific pictures and client is expected to perceive the string by listening it. Sound documents contain human voice with weighty commotions that occupy the clients. Framework has been prepared with a few pictures as well as sound documents and tested in like manner. Eman Ababtain et al. [5] et al. proposed one more system to challenge the bots for settling the signal based CAPTCHA. Signal based challenge implies client is expected to play out an activity that can be connected with the simplified based games. Barely any quite a while back, it very well may be considered as high got challenge however in the cutting edge time there are a few methodologies through which a smaller than expected game can be broken in the event that it is just in light of simplified strategy. There is no intelligence engaged with distinguishing the article or the activity which need to perform for confirming CAPTCHA according to the objective module. S.Ezhilarasi et al. [6] proposed a CAPTCHA which depends on picture recognition and navigation. The creators added commotion in the picture and makes it more confounded to understand. The creators utilize two methods for adding the clamor in the picture; either by covering two pictures or by distorting the picture. Covering the pictures isn't advantageous for human since it makes the pictures more convoluted to understand and elevated degree of distortion can confounds human to understand the issue. A CAPTCHA ought to be pretty much as helpful as workable for human and as muddled as feasible for bots.

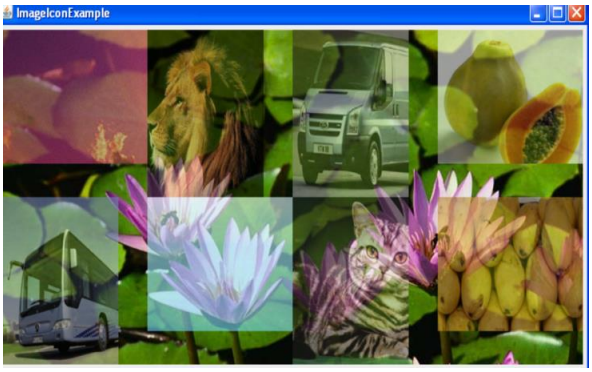

Fig. 3. Overlapping the Images [6]

Fig. 3 shows the picture recognition CAPTCHA where pictures are covered with different pictures and make it muddled for bots. However, it is frequently convoluted for human additionally to understand the picture like the main picture. MontherAldwairi et al. [7] proposed a glimmer based games. Streak based games are small games where a client is expected to play a game that might be founded on snap or intuitive. The greater part of the blaze games depend on puzzle issue. In this paper the glimmer based game is connected with the item distinguishing proof issue alongside simplified approach. Fig. 5 shows the glimmer based game where client is expected to distinguish the article; it implies what ball is utilized in soccer. There are three balls accessible around there and client needs to relocate the particular ball connected with the game. It is bit progressed as contrast with the straightforward small scale games.

III. Implementation Details

Here the framework proposes a gaming CAPTCHA where a natural circumstance present. Proposed framework depends on hard AI issue that requires on a very basic level right choice. It very well may be expressed as the circumstance based issue that an individual countenances in his day to day routine. The proposed framework depends on game hypothesis that dissecting what is going on for players and take choices appropriately. It is bit vary from the regular framework since it is additionally founded on genuine issues where human is competent to thoroughly consider it like the proposed game that can be utilized in turing test. Fig. 6 is the proposed game for CAPTCHA where user is required to use his brain and take decision accordingly. There are no incorrect decisions involved but correct decision is related to the real life problems where human is very much capable to think over it. As in fig 4 where user is required to help turn on the bulb. There are several things present in the room

where any object can be drag and drop as per the requirement to turn on the light.

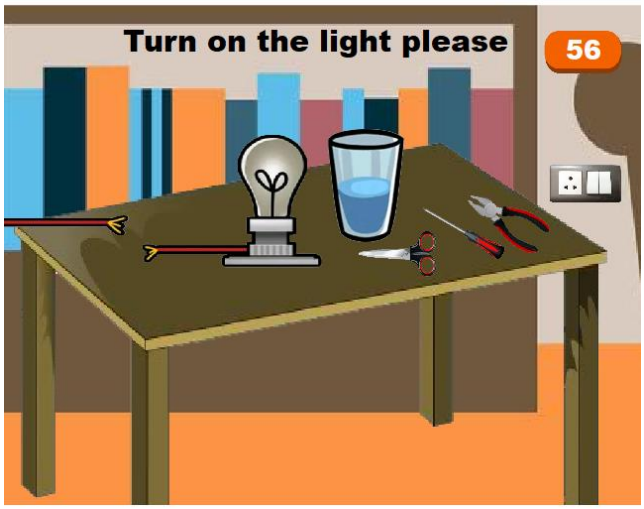

Fig. 4. Proposed Gaming CAPTCHA

But fundamentally or by using the common sence a light can be turned on by passing electricity to the broken wires. A person can easily think about this problem and can find the solution for the same but bots are not able to think over it. A glass of water can help to turn on the light by droping water where the broken wires are there, because water is great conductor of electricity that can pass the electricity and turn on the bulb successfully. Users have time limit too for finding the solution of the game. All stuffs are able to drag and drop at any location. These kinds of problems can be solved using common sense because no program can analyzed that what is required to do at this situation to turn on the light. User is required to drag the glass of water and drop at target position where problem exists. It can be solved by human very easily by almost impossible for bots to analyze it.

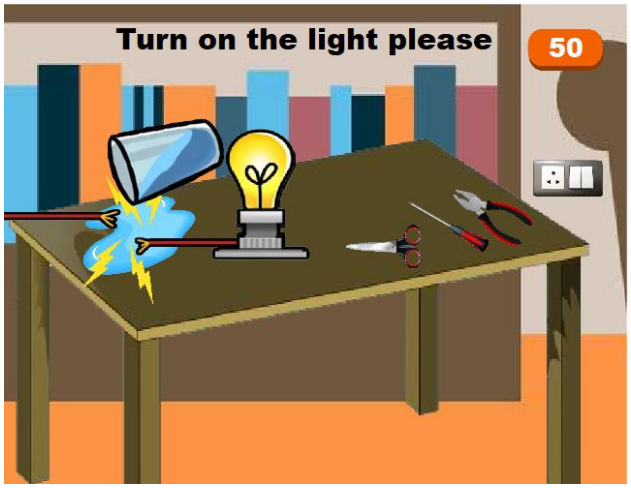

Fig. 5. Proposed Gaming CAPTCHA Solved

A solution for a game portrays the ideal decisions of the players, who could have near, conflicted with, or mixed interests, and the outcomes that could result from these decisions. The game speculation has been applied to a wide collection of conditions wherein the choices of players interface with impact the outcome. Zeroing in on the fundamental pieces of route, or perspectives compelled by the players rather than by unadulterated chance, the speculation the two improvements and goes past the dated speculation of probability. It has been used, for example, to sort out the thing mixes are likely going to shape, the power of an elector or an alliance of residents, whom to decide for a jury.

Table I Play off Matrix

	Rock	Scissor	Paper
Rock	0	1	-1
Scissor	-1	0	1
Paper	1	-1	0

The game is called lose situation on the grounds that the amount of all pays are equivalent to the zero. In this model endlessly rock pays nothing yet rock scissor pays off for the scissor and in the sets of rock and paper; rock needs to pay off adversely. Comparably for each stuff there is what is happening where something specific needs to pay off emphatically or adversely. This is a piece of game hypothesis where circumstances are involved and client is expected to take choices in like manner and there are key standards engaged with it that can be realted to the genuine circumstances. Individual games are called games against nature.

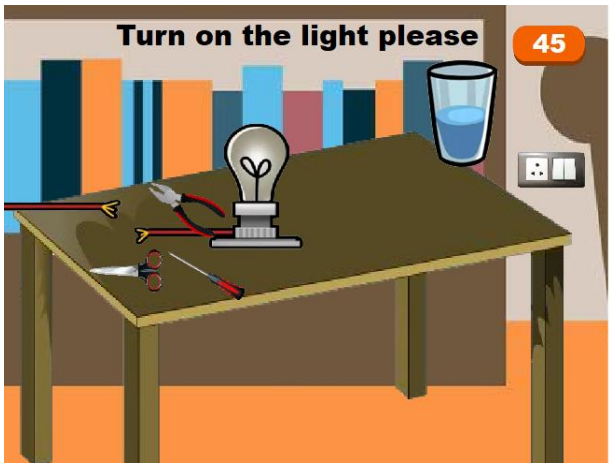

Fig. 6. Framework of the proposed gaming CAPTCHA

With no enemies, the player only necessities to list open decisions and subsequently pick the best outcome. Whenever chance is involved the game could give off an impression of being more tangled, but on an essential level the decision is still fairly clear. For example, an individual picking whether to convey an umbrella measures the costs

and benefits of conveying or not conveying it. While this individual could seek after some unsatisfactory decision, there doesn't exist an insightful enemy. That is, nature is endeavored to be totally not intrigued by the player's decision, and the individual can assemble his decision regarding direct probabilities. One-individual games hold little interest for game researchers.

A. Flow Chart

Fig 7 shows the flowchart of proposed gaming CAPTCHA where interaction started with a game and when the game has been begun; a clock began.

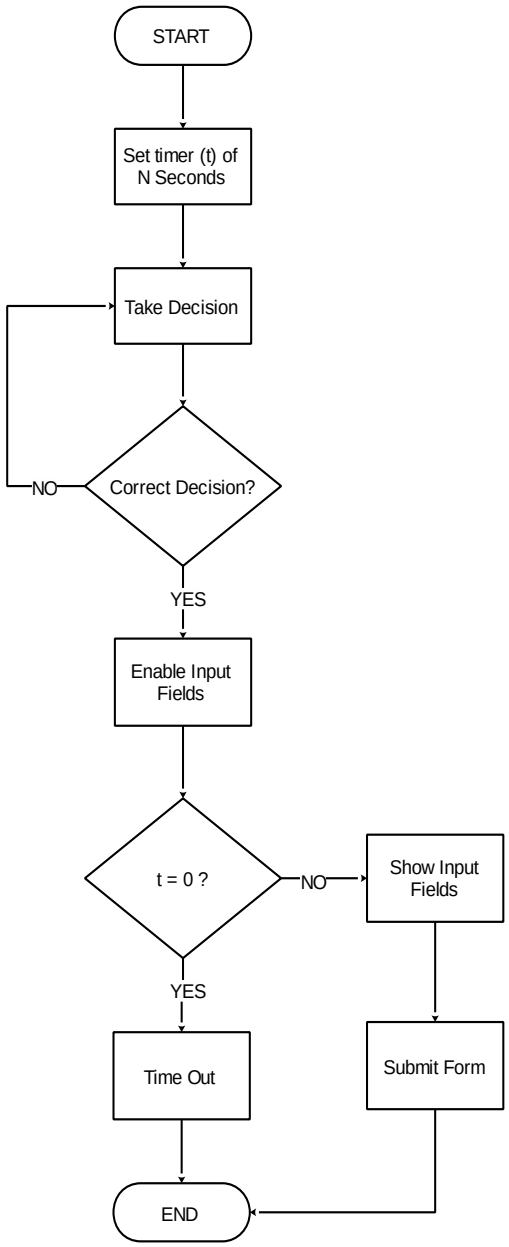

Fig. 7. Flowchart of the proposed gaming CAPTCHA

The time furthest reaches of the game is brief which is adequate to thoroughly consider it and take choice appropriately. Framework continues to check regardless of whether client endeavored the right choice. When the right choice has been made; the info fields get showed up and client can present the structure and cycle become end. In any case, a client continues to look for the arrangement and not ready to take choice; it very well may be client is robot or a piece of program.

B. Game Theory Algorithm

Table II addresses the Game Theory Algorithm which depends on powerful game hypothesis approach. As a matter of some importance game is to be instate with time t. Every single dragable item has own directions can be changed when client moves the item to the new area. In this way, new area is to be figured at every developments. Among all items there is an objective article and framework continue to refresh the area of target object too. At the point when client find the objective article and raises a ruckus around town area then that will be cosidered as the right choice yet client needs to find and drag the objective item ot the objective area until t isn't equivalent to 0. On the off chance that time is finished, CAPTCHA check become fizzled and reload button shows up and when the client click on reload button then another particular circumstance will show up.

Table II Game Theory Algorithm

Game Theory Algorithm

Step 1: Initialize coordinates
Step 2: Set time t ← N sec
Step 3: $T_o(x_t, y_t) \leftarrow (x_1, y_1), (x_2, y_2), \ldots\ldots (x_n, y_n)$
Step 4: $T_o \leftarrow$ (left, right, bottom, top) //drag & drop
Step 5: Compute updated coordinates of the object

$$x_{new} = left_{new} + \left(\left(\frac{x_{old} - left_{old}}{right_{old} - left_{old}}\right) \times (right_{new} - left_{new})\right)$$

$$y_{new} = top_{new} + \left(\left(\frac{y_{old} - top_{old}}{bottom_{old} - top_{old}}\right) \times (bottom_{new} - top_{new})\right)$$

Where x_{new} and y_{new} are the new location of the object after drag & drop.

Step 6: if $T_o(x_{new}, y_{new})$ hits T_L // T_LTarget Location
{
Correct ← Decision
True ← Input Fields Visibility;
}
else
Incorrect ← Decision
Flase ← Input Fields Visibility;
end else
end if
Step 7: while (t > 0) do
Repeat Step 5 & 6;
end while

Step 8: if t = 0 **then**
Verification Failed← t //timer
end if
Step 9: End

IV. EXPERIMENTAL RESULT

Trial result depends on specific boundaries for example normal time taken to settle the CAPTCHA, most reduced time recorded by the framework, number of effective clients, number of ineffective clients, standard deviation, difference, picture illustrations of the CAPTCHA, intricacy and impediment.

Table III Experimental Results

Terms & Parameters	Proposed
Total Number of Users	30
Total Number of Successful Users	30
Total No. of Unsuccessful Users	0
Lowest Time Recorded	5
Mean Time Recorded	8.83
Standard Deviation	2.61
Variance	6.83

Table III shows the result of the proposed system. Table IV shows the frequency table of the participation.

Table IV Frequency Table

Time	Frequency	Cumulative frequency	Relative frequency	Cumulative relative frequency
5	1	1	0.033	0.033
6	6	7	0.2	0.23
7	5	12	0.17	0.4
8	3	15	0.1	0.5
9	2	17	0.067	0.567
10	5	22	0.167	0.733
11	5	27	0.0167	0.9
12	1	28	0.033	0.933
15	2	30	0.067	1

Table V represents the result comparison of the proposed system with earlier proposed systems.

Table V Result Comparison

Terms & Parameters	S.Ezhilarasi [6]	Proposed
Total No. of Participants	30	30
Total No. of Successful Participants	29	30
Total No. of Unsuccessful Participants	1	0
Mean Time Recorded (μ)	15	8.83
Lowest Time Recorded	6	5
Precision of Success	0.97	1
Precision of Failure	0.03	0
Image Graphics	Complicated	Simple & Decisive
Complexity	Moderate	Easy
Limitations	English Language Skills	Common Sense Required

V. CONCLUSION & FUTURE SCOPE

Inherent choice based circumstance response CAPTCHA is the cutting edge challenge for bots to address it with intellectual endeavors. The proposed challege can characterize the human among bots or bots among human. Proposed challenge depends on hard AI issue since client expects to settle the CAPTCHA by taking choices by his good judgment. Proposed challenge depends on circumstances and client can tackle the issue in the span of few moments simply by utilizing good judgment or the choice which is generally right. For instance on the off chance that an individual is very thristy and he has offer for a glass of water and some tea then what stuff he ought to pick, offcourse it ought to be a glass of water that check out assuming that individual is thristy. There are a few intellectual circumstances where human is reasonable to tackle it in a given time yet machine is wasteful to take care of these sort of issues. In future the circumstance can be more unmistakable and appealing by creating it more simpler and human can settle the particular significantly quicker. Framework related better degree of execution as contrast with the base paper and prior proposed frameworks.

REFERENCES

[1] Web Management. reCAPTCHA Component. https://ubcms.buffalo.edu/help/components-library/form/recaptcha-component.html.Accessed 16 July 2022.

[2] Dennis Goedegebuure. You Are Helping Google AI Image Recognition. https://medium.com/@thenextcorner/you-are-helping-

google-ai-image-recognition-b24d89372b7e.Accessed 14 April 2022.

[3] 24 Accessibility. Prove You're Not A Bot: reCAPTCHA version 3. https://www.24a11y.com/2018/recaptcha/.Accessed 16 July 2022.

[4] Cakmak, Ahmet & Balcilar, Muhammet. (2019). Audio Captcha Recognition Using RastaPLP Features by SVM.

[5] Ababtain, Eman; Engels, Daniel (2019). [IEEE 2019 International Conference on Computational Science and Computational Intelligence (CSCI) - Las Vegas, NV, USA (2019.12.5-2019.12.7)] 2019 International Conference on Computational Science and Computational Intelligence (CSCI) - Gestures Based CAPTCHAs the Use of Sensor Readings to Solve CAPTCHA Challenge on Smartphones. , (), 113–119. doi:10.1109/CSCI49370.2019.00026

[6] S. Ezhilarasi and P. U. Maheswari, "Image Recognition and Annotation based Decision Making of CAPTCHAs for Human Interpretation," 2020 International Conference on Innovative Trends in Information Technology (ICITIIT), 2020, pp. 1-6, doi: 10.1109/ICITIIT49094.2020.9071558.

[7] Aldwairi, M., Mohammed, S., & Padmanabhan, M. L. (2020). Efficient and secure flash-based gaming CAPTCHA. Journal of Parallel and Distributed Computing. doi:10.1016/j.jpdc.2020.03.020

[8] Cakmak, Ahmet & Balcilar, Muhammet. (2019). Audio Captcha Recognition Using RastaPLP Features by SVM.

[9] N. Payal and R. K. Challa, "AJIGJAX: A hybrid image based model for Captcha/CaRP," 2016 IEEE Uttar Pradesh Section International Conference on Electrical, Computer and Electronics Engineering (UPCON), 2016, pp. 38-43, doi: 10.1109/UPCON.2016.7894621.

[10] Cao Lei, "Image CAPTCHA technology research based on the mechanism of finger-guessing game," Third International Conference on Cyberspace Technology (CCT 2015), 2015, pp. 1-4, doi: 10.1049/cp.2015.0843.

[11] Yu, Hong and Mark O. Riedl. "Automatic Generation of Game-based CAPTCHAs." (2015).

[12] S. Vikram, Chao Yang and Guofei Gu, "NOMAD: Towards non-intrusive moving-target defense against web bots," 2013 IEEE Conference on Communications and Network Security (CNS), 2013, pp. 55-63, doi: 10.1109/CNS.2013.6682692.

[13] Z. Li and Q. Liao, "CAPTCHA: Machine or Human Solvers? A Game-Theoretical Analysis," 2018 5th IEEE International Conference on Cyber Security and Cloud Computing (CSCloud)/2018 4th IEEE International Conference on Edge Computing and Scalable Cloud (EdgeCom), 2018, pp. 18-23, doi: 10.1109/CSCloud/EdgeCom.2018.00013.

[14] Aadhirai R, Sathish Kumar P J and Vishnupriya S, "Image CAPTCHA: Based on Human Understanding of Real World Distances" Proceedings of 4th International Conference on Intelligent Human Computer Interaction, IEEE 2012.

[15] Ibrahim FurkanInce, YucelBatu Salman, Mustafa ErenYildirim and Tae-Cheon Yang, "Execution Time Prediction For 3D Interactive CAPTCHA By Keystroke Level Model" in Fourth International Conference on Computer Sciences and Convergence Information Technology of IEEE 2009.

[16] JingSong Cui, LiJing Wang, JingTing Mei, Da Zhang, Xia Wang, Yang Peng, WuZhou Zhang, "CAPTCHA Design Based on Moving Object Recognition Problem" in IEEE 2009.

[17] Jing-Song Cui, Jing-Ting Mei, Xia Wang, Da Zhang, Wu-Zhou Zhang , "A CAPTCHA Implementation Based on 3D Animation" in International Conference on Multimedia Information Networking and Security of IEEE 2009.

[18] S. Bera, S. Misra, J. J. P. C. Rodrigues, Cloud computing applicationsfor smart grid: A survey, IEEE Transactions on Parallel and DistributedSystems 26 (5) (2015) 1477–1494. doi:10.1109/TPDS.2014.2321378.

[19] N. Komninos, E. Philippou, A. Pitsillides, Survey in smart grid andsmart home security: Issues, challenges and countermeasures, Com-munications Surveys & Tutorials, IEEE 16 (2014) 1933–1954. doi:10.1109/COMST.2014.2320093.

[20] S. Asri, B. Pranggono, Impact of Distributed Denial-of-Service Attackon Advanced Metering Infrastructure, Wireless Personal Communica-tions 83 (3) (2015) 2211–2223. doi:10.1007/s11277-015-2510-3.URL https://doi.org/10.1007/s11277-015-2510-3

[21] T. Baker, B. Aldawsari, M. Asim, H. Tawfik, Z. Maamar, R. Buyya,Cloud-senergy: A bin-packing based multi-cloud service broker for en-ergy efficient composition and execution of data-intensive applications,Sustainable Computing: Informatics and Systems 19 (2018) 242 – 252.doi:https://doi.org/10.1016/j.suscom.2018.05.011.URL http://www.sciencedirect.com/science/article/pii/S2210537918300398

[22] B. Al-Duwairi, A. Al-Hammouri, M. Aldwairi, V. Paxson, Gflux: Agoogle-based system for fast flux detection, in: 2015 IEEE Conferenceon Communications and NetworkSecurity, CNS 2015, 2015, pp. 755–756.doi:10.1109/CNS.2015.7346920.URL https://doi.org/10.1109/CNS.2015.7346920

[23] M. Aldwairi, A. M. Abu-Dalo, M. Jarrah, Pattern matching ofsignature-based IDS using Myers algorithm under MapReduce frame-work, EURASIP Journal on Information Security 2017 (1) (2017) 9.doi:10.1186/s13635-017-0062-7.URL https://doi.org/10.1186/s13635-017-0062-7

[24] M. Shirali-Shahreza, S. Shirali-Shahreza, Question-based captcha, in:Conference on Computational Intelligence and Multimedia Applications,2007. International Conference on, Vol. 4, 2007, pp. 54–58. (PDF) Efficient and secure flash-based gaming CAPTCHA. Available from: https://www.researchgate.net/publication/340668007_Efficient_and_secure_flash-based_gaming_CAPTCHA [accessed Jul 16 2022].