Recording Eye-tracking Parameters during a Program Source-code Debugging Example

Jozsef Katona[1], Attila Kovari[2]
CogInfoCom Based LearnAbility Research Team
[1]Institute of Computer Engineering, [2]Institute of Engineering, University of Dunaujvaros
Dunaujvaros, Hungary
[1]katona.jozsef@hotmail.hu; [2]kovariati@outlook.com

Ilona Heldal[1], Carsten Helgesen[2]
Department of Computing, Mathematics, and Physics
Western Norway University of Applied Sciences
Bergen, Norway
[1]ilona.heldal@hvl.no; [2]carsten.helgesen@hvl.no

Cristina Costescu[1], Adrian Rosan[2], Andrea Hathazi[3]
Special Education Department
Faculty of Psychology and Educational Sciences, Babes-Bolyai University
Cluj-Napoca, Romania
[1]cristina.costescu@ubbcluj.ro, [2]adrian.rosan@ubbcluj.ro; [3]andrea.hathazi@ubbcluj.ro

Serge Thill
Donders Centre for Cognition
Donders Institute for Brain, Cognition, and Behaviour
Radboud University
Nijmegen, Netherland
s.thill@donders.ru.nl

Robert Demeter
Department of Automation and Information Technology
Faculty of Electrical Engineering and Computer Science,
Transilvania University of Brasov
Brasov, Romania
rdemeter@unitbv.ro

Abstract for Demonstration

Abstract—**Recently, researches based on eye-tracking have more often appeared on the field of cognitive studies, education support systems and virtual reality. Eye-tracking based analysis may be useful in IT, particular in algorithm thinking, program code debugging. The purpose of this paper is to introduce the conditions of Gazepoint GP3 device and OGAMA used to record eye-motion parameters and demonstrate the recording process and steps.**

I. Introduction

Human-computer interface-based systems are present in more and more research areas, such as cognitive examinations [1-6], education support [7-22], virtual reality, 3D [23-31], and developed systems, analyses are directly related to Cognitive InfoCommunications (CogInfoCom) issues [32].

We can observe the world around us using our eyes, and get information about its details. Thanks to eye-tracking, we can examine the direction of the person's look, while recording the eye's motion relative to the head. The operation of visual information reception and the essential factors of eye's operation were clarified by the end of the 1980s and 1990s, respectively. [33], [34]

The purpose of the research [35] is to examine how and with what efficiency can the testing subject solve errors hidden into an algorithm. During the test, the trail of the testing subjects' look was continuously recorded. During the test, a GazePoint GP3 eye-tracker hardware unit was used, as well as the OGAMA (OpenGazeAndMouseAnalyzer) software application to observe the eye motion and to record its parameters.

II. The test's steps

Before connecting the eye-tracking hardware unit to the computer, we installed the Gazepoint software package, which included the camera driver too. Following the successful installation, we connected the device. Following connection, we placed the device below the display, avoiding sun directly hitting the testing subjects' face. The distance from the eye was 65 cm in all cases.

Following the placement of the device, Visual Studio 2017 Community development environment was launched, in which the incorrect source-code part was inserted to fill the screen by the applied paste organizer method as much as possible. (Fig. 1).

978-1-7281-4793-2/19/$31.00 ©2019 IEEE

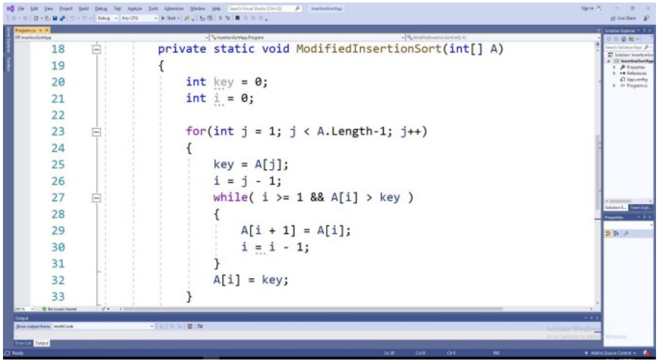

Fig. 1. Modified Insertion-Sort Algorithm in Visual Studio 2017 Community

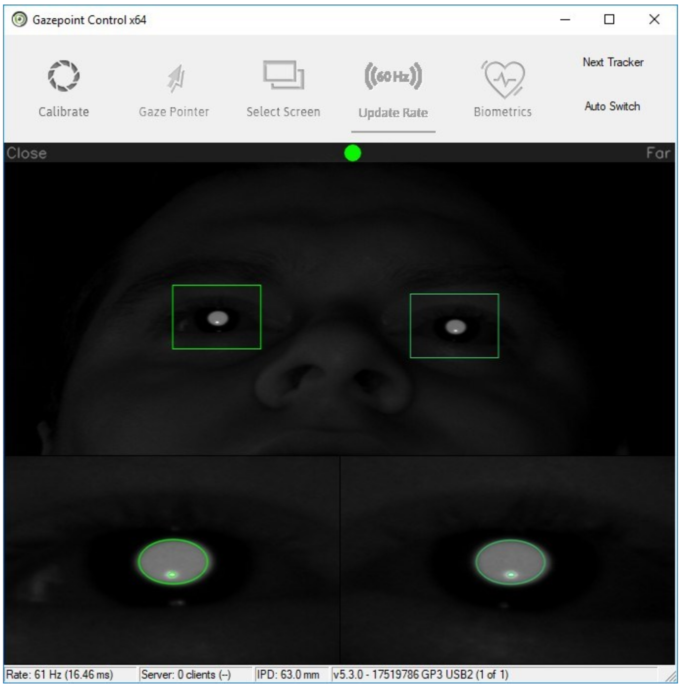

Fig. 2. Gazepoint Control

After starting the Visual Studio 2017 Community, we put it onto the tray and launched the Gazepoint Control software (Fig. 2.), which operated as gaze-data server, thus providing real-time data. Following a successful server set-up, we launched the OGAMA software.

Following preparations, we asked the testing subject to sit down and explained the test method in details. Before the beginning of the test, we selected the Recording module in the OGAMA software, connected it to the eye-tracking software unit and saved the testing subject's data. The successful recording of the data was followed by the calibration of the device when the testing subject had to follow a circle starting from the screen's upper-left corner without moving his/her head. The calibration could be performed by a person even multiple times to achieve the best results. Following the successful calibration operation, the testing subject started the troubleshooting and fixing. During the process, different eye motion parameter was recorded, and we saved them at the end of the test into a database for further evaluation purposes. (Fig. 3.). The detailed results of the research are published in the announcement [23].

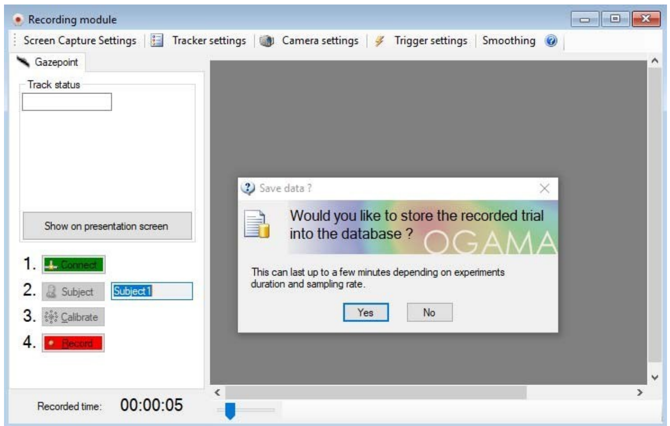

Fig. 3. Recording module of OGAMA

III. Conclusion

In this paper, Gazepoint GP3 eye-tracker tool and OGAMA data collector any analyser software provide efficient help to perform tests related to eye-tracking. The so assembled system may be appropriately applied in eye motion based researches.

Acknowledgement

The project is sponsored by EFOP-3.6.1-16-2016-00003 founds, Consolidate long-term R and D and I processes at the University of Dunaujvaros.

References

[1] J. Katona, A. Kovari, „Examining the Learning Efficiency by a Brain-Computer Interface System," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 251-280, 2018.

[2] J. Katona, A. Kovari, „The Evaluation of BCI and PEBL-based Attention Tests," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 225-249, 2018.

[3] M. Maldonato P. Valerio, P., "Artificial entities or moral agents? How AI is changing human evolution," In Multidisciplinary approaches to neural computing, Springer, Cham, 2018, pp. 379-388.

[4] M. Maldonato, S. Dell'Orco, "Adaptive and evolutive algorithms: a natural logic for artificial mind," In Toward Robotic Socially Believable Behaving Systems-Volume II, Springer, Cham, 2016, pp. 13-21.

[5] M. Gósy, V. Krepsz, „Evaluation of Cognitive Processes using Synthesized Words: Screening of Hearing and Global Speech Perception," *Acta Polytechnica Hungarica*, vol. 15, no. 5, pp. 31-45, 2018.

[6] M. Miroslav, „Cognitive Aspects of Spatial Orientation," *Acta Polytechnica Hungarica*, vol. 15, no. 5, pp. 149-167, 2018.

[7] Cs. Rigóczki, A. Damsa, K. Györgyi-Ambró, „Gamification on the edge of educational sciences and pedagogical methodologies," *Journal of Applied Technical and Educational Sciences*, vol. 7, no. 4, pp. 79-88, 2017.

[8] B. Lampert, et al., „MaxWhere VR-learning improves effectiveness over clasiccal tools of e-learning," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 125-147, 2018.

[9] L. Bognár, É. Fáncsikné, P. Horváth, A. Joós, B. Nagy, and G. Strauber, "Improved learning environment for calculus courses", *Journal of*

Applied Technical and Educational Sciences, vol. 8, no. 4, pp. 35-43, 2018.

[10] Gy. Molnár, Z. Szűts, K. Biró, „Use of Augmented Reality in Learning," *Acta Polytechnica Hungarica*, vol. 15, no. 5, pp. 209-222 , 2018.

[11] Gy. Molnár, "The Impact of Modern ICT-based Teaching and Learning Methods in Social Media and Networked Environment", In: Milan, Turčáni; Zoltán, Balogh; Michal, Munk; Ľubomír, Benko (ed.) *11th International Scientific Conference on Distance Learning in Applied Informatics*, Wolters Kluwer, 2016. pp. 341-350.

[12] Gy. Molnár and A. Benedek, "ICT Related Tasks and Challenges In The New Model of Technical Teacher Training" In: John, Terzakis; Constantin, Paleologu; Tibor, Gyires (ed.) InfoWare 2013: ICCGI 2013: *The Eighth International Multi-Conference on Computing in the Global Information Technology,* 2013. pp. 40-44.

[13] Gy. Molnár, "The role of electronic and virtual learning support systems in the learning process", In: Szakál, Anikó (ed.) *IEEE 8th International Symposium on Applied Computational Intelligence and Informatics* : SACI 2013, IEEE, 2013. pp. 51-54.

[14] M. J. Haigh, "Connective practices in sustainability education," *Journal of Applied Technical and Educational Sciences*, vol. 7, no. 4, pp. 6-30, 2017.

[15] V. Kövecses-Gősi, „Cooperative Learning in VR Environment," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 205-224, 2018.

[16] R. Pinter and S. M. Cisar, "Measuring Team Member Performance in Project Based Learning", *Journal of Applied Technical and Educational Sciences*, vol. 8, no. 4, pp. 22-34, 2018.

[17] K. Chmielewska, A. Gilanyi, „Educational Context of Mathability," *Acta Polytechnica Hungarica*, vol. 15, no. 5, pp. 223-237, 2018.

[18] P. Baranyi and A. Gilányi, "Mathability: Emulating and enhancing human mathematical capabilities," *2013 IEEE 4th International Conference on Cognitive Infocommunications (CogInfoCom)*, Budapest, 2013, pp. 555-558.

[19] K. Chmielewska and A. Gilányi, "Mathability and computer aided mathematical education," *2015 6th IEEE International Conference on Cognitive Infocommunications (CogInfoCom)*, Gyor, 2015, pp. 473-477.

[20] K. Chmielewska, A. Gilányi and A. Łukasiewicz, "Mathability and mathematical cognition," *2016 7th IEEE International Conference on Cognitive Infocommunications (CogInfoCom)*, Wroclaw, 2016, pp. 245-250.

[21] K. Chmielewska and A. Gilányi, " Computer Assisted Activating Methods in Education," *2019 10th IEEE International Conference on Cognitive Infocommunications (CogInfoCom)*, Naples, 2019, in press

[22] F. Mónus and C. Lechner, "An innovative way in education for sustainable development: e-School4s – e-school for sustainability in the Danube region", *Journal of Applied Technical and Educational Sciences*, vol. 7, no. 4, pp. 89-96, 2017.

[23] I. Horvath, A. Sudar, „Factors contributing to the enhanced performance of the maxwhere 3d vr platform in the distribution of digital information," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 149-173, 2018.

[24] T. Budai, M. Kuczmann, „Towards a Modern, Integrated Virtual Laboratory System," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 191-204, 2018.

[25] D. Geszten, et al., „A Content-Analysis Approach for Exploring Usability Problems in a Collaborative Virtual Environment," *Acta Polytechnica Hungarica*, vol. 15, no. 5, pp. 67-88, 2018.

[26] B. Berki, „2d advertising in 3d virtual spaces," *Acta Polytechnica Hungarica*, vol. 15, no. 3, pp. 175-190, 2018.

[27] I. Horváth, "The educoaching method in the service of efficient teaching of disruptive technologie" chapter in book Cognitive Infocommunications Theory and Applications, Springer e-book 2018. ISSN 2193-942X, ISBN 978-3-319-95996-2

[28] I. Horváth: "Innovative engineering education in the cooperative VR environment", In: Proceedings of 7th IEEE Conference on Cognitive Infocommunications. 496 p. Wrocław, Poland, 16-18.10.2016. Budapest: IEEE Hungary Section, 2016. pp. 359-364. (ISBN 978-1-5090-2644-9; 978-150902645-6),

[29] I. Horváth: "Disruptive technologies in higher education", In: Proceedings of 7th IEEE Conference on Cognitive Infocommunications. Wrocław, Poland, 16-18.10.2016. Budapest: IEEE Hungary Section, 2016. pp. 347-352. (ISBN 978-1-5090-2644-9; 978-150902645-6)

[30] R. Pinter, et al. "Measuring Team Member Performance in Scrum-Case Study", Proceedings of 15th IEEE International Symposium on Intelligent Systems and Informatics. Subotica, 2017, pp 309-314

[31] I. Horváth (2019) MaxWhere 3D capabilities contributing to the Enhanced Performance of Trello 2D software, Acta Polytechnica Hungarica in print

[32] P. Baranyi, A. Csapo, Gy. Sallai, Cognitive Infocommunications (CogInfoCom), Springer International Publishing Switzerland, 2015.

[33] K. Rayner, *Eye Movement in Reading. Perceptual and Language Processes*. Academic Press. New York, 1983.

[34] K. Rayner, "Eye movements in reading and information processing: 20 years of research", in *Psychological Bulletin*, vol. 124, no. 3, pp. 372-422, 1998.

[35] J. Katona, et al., "The Examination Task of Souce-code Debugging Using GP3 Eye Tracker" *2019 10th IEEE International Conference on Cognitive Infocommunications (CogInfoCom)*, Naples, Italy, 2019, in press.