

Smart Ai-Based Online Proctoring

**M. M. Sardeshmukh, Shradha Kulkarni, M. A. Kumbhalkar, S. A. Choudhari, D. V. Bhise,
Dr. S. W. Shaikh**

JSPM Narhe Technical Campus, Narhe
mmsardeshmukh2016@gmail.com

Abstract- The use of online examination is increasing in Industry to save the time and money in the process. It is challenging to monitor the online candidates by a single supervisor as in traditional practice. We have proposed here an online exam portal along with the online monitoring module. The module one contains the addition of the questions setting up the rules and regulations for exam. The part two is related to monitoring, All the abnormal activities are monitored and alert message sent to the candidates about the same. If it is observed the alerts are more than the chances given the examination stopped automatically. This will help the organizations and academic institutes to conduct the online examinations and save money and man hours. Results shows the different cases of the suspicious activities and the normal activities.

Keywords: Online proctoring, proctor panel, exam panel, monitoring, artificial intelligence;

I. INTRODUCTION

The use of online examination is increasing day by day. The use of online exam is beneficial for all as it save man-hours travelling and many other resources.[1,2] The big challenge is proctoring online exam as many of the issues involved in it. The paper focuses use of different techniques like face detection, face recognition, head movement, mobile usage etc. to find if the candidate is malpracticing[3-5].

The paper is divided into two parts. One part is named Proctor Panel which is used by Proctors for administrating the examination system by adding questions/answers, creating and scheduling exams, and getting different reports related to the exam progress and proctoring. While second part named Exam Panel[6] is about monitoring candidates while taking the exam. Both the parts are websites developed using the latest technologies like Angular (frontend), Express (backend), [7] Flask (backend)[8] and MongoDB(database)[9] which will open in any browser on any operating system[10]. Face recognition is the technique in which the identity of a human being can be

identified using one individual face. Such kind of systems can be used in photos, videos, or in real-time machines[11]. The objective of this article is to provide a simpler and easy method in machine technology. With the help of such a technology one can easily detect the face with the help of a dataset with a similar matching appearance of a person[12-15].

Face recognition is a non-invasive identification system and faster than other systems since multiple faces can be analysed at the same time. [16]. The difference between face detection and identification is, that face detection is to identify a face from an image and locate the face. Face recognition[17] is making the decision “whose face is it ? ”, using an image database. The following table compares different methods and techniques used for online proctor monitoring systems along with its limitations.[18]

Table 1-Compares different methods and techniques used for online proctor monitoring

N O	Title	AUTHORS	ADVANTAGE AND DISADVANTAGES
1.	An Incremental Training on Face Recognition for Online Exam Proctoring	AsepHadianSudrajatGanid isastra, Yoanes Institute Teknologi Bandung, Indonesia	This paper describes an incremental training process for face recognition training, hence there is no need to add another process this will reduce the computation cost and time.
2.	Students Online Exam Proctoring: A Case Study Using 360 Degree Security Cameras	Aiman A Turani , Jawad H Alkhateeb, AbdulRahman A. AlsewariAlMadinahAlmun awareh, Kingdome of Saudi Arabia	They investigated 360-degree security cameras over the traditional webcam to enhance exam security and minimize the restrictions.
3.	Online Student Authentication and Proctoring System Based on Multimodal Biometrics Technology	MIKEL LABAYEN, RICARDO VEA, JULIÁN FLÓREZ, NAIARA AGINAKO BASILIO SIERRA	This paper describe the solution based on the authentication of different biometric technologies and an automatic proctoring system (system workflow as well as AI algorithms), which incorporates features to solve the main concerns in the market.

4.	Heuristic-based Automatic Online Proctoring System	Vishn u Raj R S, Athi Narayanan S Kamal Bijlani	This paper proposed a multi-modal method for online proctoring using a combination of image processing, audio proctoring and PC monitoring techniques.
5.	Education Technology for Online Learning in Times of Crisis	HaiyanCai, Irwin King	They developed an online learning and assessment tool in times of crisis. First, they examined the use of online learning and teaching tools by administrators, teachers, and students. Second, they compared twelve proctoring systems for online assessment. Thirdly, they have presented a basic evaluation framework for proctoring systems. Last, a mixed set of options in using proctoring systems.
6.	An Intelligent System For Online Exam Monitoring	SwathiPrathish, Athi Narayanan S and Kamal Bijlani	This paper avoid the physical presence of a proctor throughout the exam by creating a comprehensive multi-modal system. They have used hardware such as a webcam to capture audio and video along with active window capture. Developing a multi-modal system they have checked any malpractices that have happened. They even talk about face detection and a head pose.
7.	A Systematic Review of Online Exams Solutions in E-Learning: Techiques, Tools and Global Adoption	Abdul WahabMuzaffar, Muhammad Tahir, Muhammad Waseem Anwar, QaiserChaudry, Shamaila Rasheed Mir And Yawar Rasheed	In this paper, a Systematic Literature Review (SLR) of online examination is performed to select and analyze 53 studies published during the last five years (i.e. Jan 2016 to July 2020)



8.	Online Examination System with Cheating Prevention Using Question Bank Randomization and Tab Locking	Samuel S. Chua, Zechariah R. Lumapas, Joshuel B. Bondad and Joven DL. Garcia, this system	This system talks about the ability to address academic malpractice. Randomization of the exam can address academic malpractice, this would provide the examiners with different exams that would make them unable to commit such acts.
----	--	---	---

2. LITERATURE REVIEW-

Aiman A Turani ,Jawad H Alkhateeb and AbdulRahman A. Alsewari presented their new approach for developed for exam proctoring using a 360-degree security camera. They investigated 360-degree security cameras over the traditional webcam to enhance exam security and minimize the restrictions. With the help of an automated proctoring model that has removed the need for real-time proctoring and scheduling constraints to prevent cheating is proposed in this paper. They have checked the project by volunteer students from computer science and engineering colleges. Mikelet. al. describe the solution based on the authentication of different biometric technologies and an automatic proctoring system (system workflow as well as AI algorithms), which incorporates features to solve the main concerns in the market. They need to ensure that these students complete all the activities of online training without cheating or inappropriate behaviours. With the help of technology, they have performed a test of the large-scale system.

Vishn u Raj R S, Athi Narayanan S and Kamal Bijlani proposed a multi-modal method for online proctoring using a combination of image processing, audio proctoring and PC monitoring techniques . In this system, the remote proctor has to inspect the examination room. They have evaluated with a dataset mimicking the malpractice scenarios, the accuracy of the system is demonstrated with a false positive rate of 0.08 and a true negative rate of 0.13. HaiyanCai and Irwin King developed an online learning and assessment tool in times of crisis.

First, they examined the use of online learning and teaching tools by administrators, teachers, and students. There are some security issues associated with online learning tools, the benefits of online learning include feasibility, flexibility and accessibility. Second, they compared twelve proctoring systems for online assessment. Thirdly, they have presented a basic evaluation framework for proctoring systems. Last, a mixed set of options in using proctoring systems. SwathiPrathish, Athi Narayanan S and Kamal Bijlani in this paper avoid the physical presence of a proctor throughout

the exam by creating a comprehensive multi-modal system. They have used hardware such as a webcam to capture audio and video along with active window capture. Developing a multi-modal system they have checked any malpractices that have happened. They even talk about face detection and a head pose. Misconduct is detected based on yaw angle variations, audio presence and active window capture.

Abdul Waheb et.al.explained a study summarizing and analyzing the latest developments, particularly in the area of online examination, is hard to find in the literature In this paper, a Systematic Literature Review (SLR) of online examination is performed to select and analyze 53 studies published during the last five years (i.e. Jan 2016 to July 2020). Subsequently, five leading online exam features targeted in the selected studies are identified. In addition, underlying development approaches for the implementation of online exam solutions are explored. Furthermore, 16 important techniques/algorithms and 11 datasets are presented. Finally, the participation of countries in online exam research is investigated. Key factors for the global adoption of online exams are identified and compared with major online exam features.

Samuel S. Chua, Zechariah R. Lumapas, Joshuel B. Bondad and Joven DL. Garcia, this system talks about the ability to address academic malpractice. Randomization of the exam can address academic malpractice, this would provide the examiners with different exams that would make them unable to commit such acts. The research looked into interviewing through a focus group the proctors of online exams to identify root causes of academic malpractice at the same time interview exam content creators on possible approaches to exam question generators that allow a validity of a measure of outcomes. A significant benefit is an immediate feedback to students on homework assignments and examinations.

After reviewing many articles it is observed that there is a huge demand for online proctoring using machine learning[19] and AI[20]. We have developed an integrated system using machine learning[21] that can perform combined operations of the Proctor Panel and Exam Panel. This paper presents various modules like Developing a system for adding questions/answers and quizzes, registering students, recognizing student's faces[22] for validating students, detecting head[23], eye and lip [24]movements to check if the student is cheating in the exam[25], exam verification[26], certificate generation[27] and generating required reports[28].

III METHODOLOGY

The system comprises of the following main blocks which is divided in to two major subsystems.[30]

Proctor panel - managed by the examiner and Examinerpanel[31] – used by the user to write the examination[32]. All the activities are monitored by the system[33] and alerts generated for the fraudulent observations. The alerts sent to examiners as well as log of the same is maintained as record.

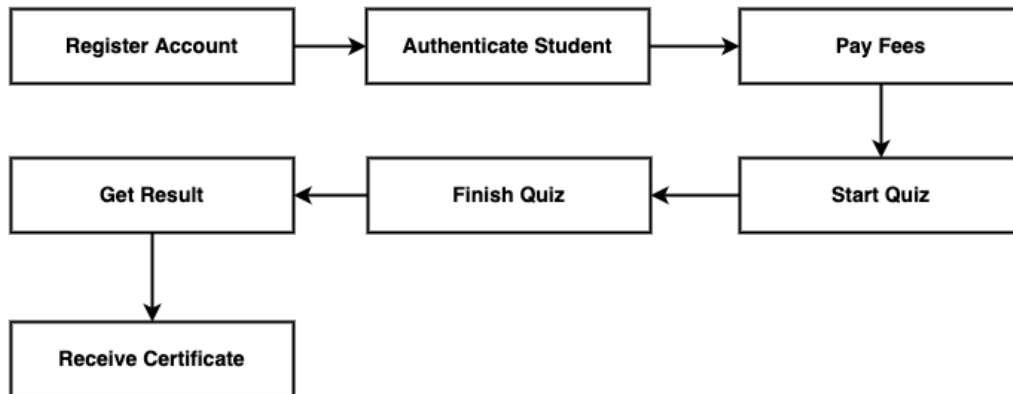
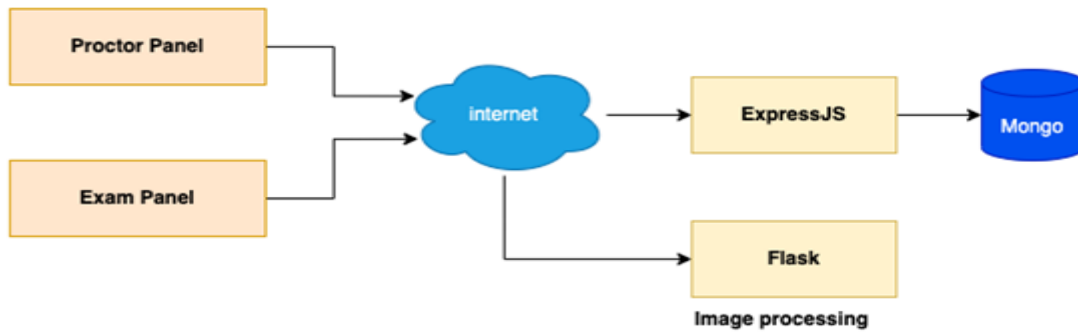


Figure 2- Exam Panel Activities Flow

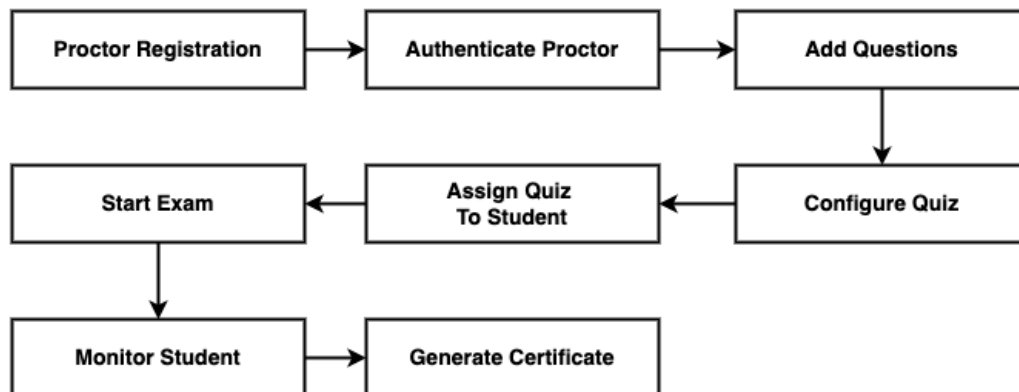


Figure a

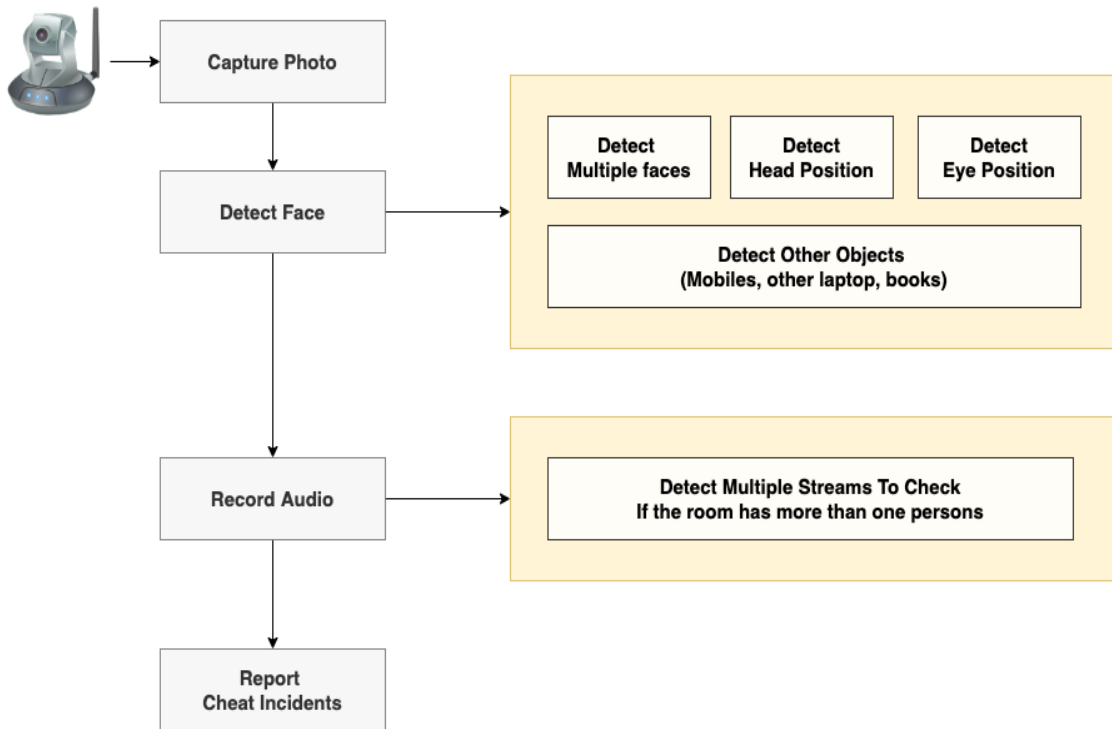


Figure b

Figure 3(a, b)-Proctor Panel Activities Flow

IV. Results and Conclusion:

The following figures indicate the results obtained for different situations.

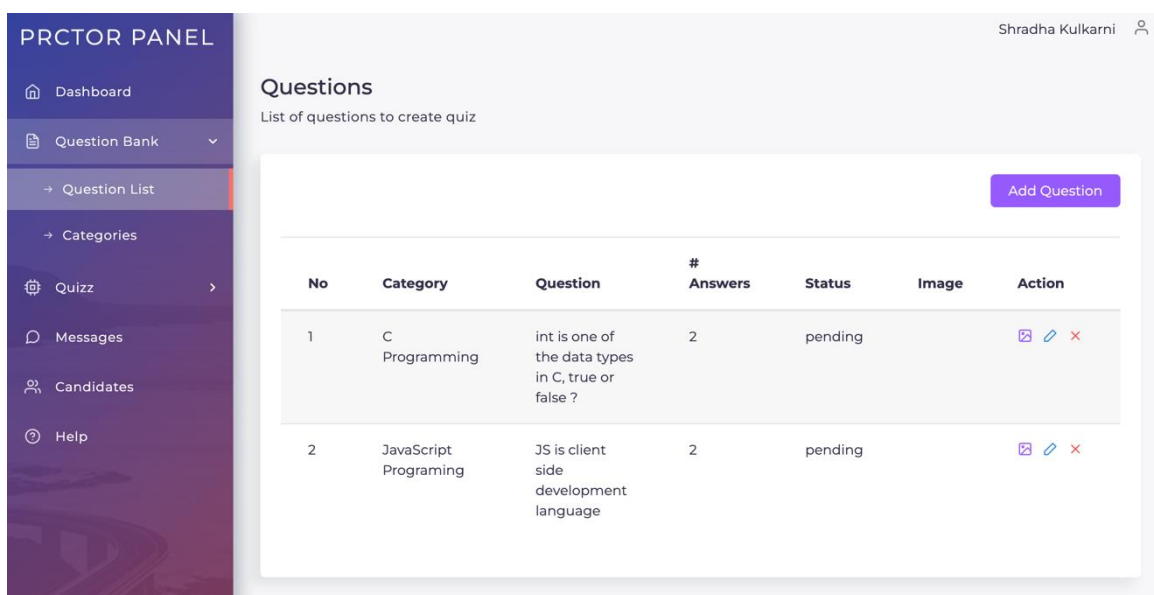


Figure 4- Results obtained for different situations

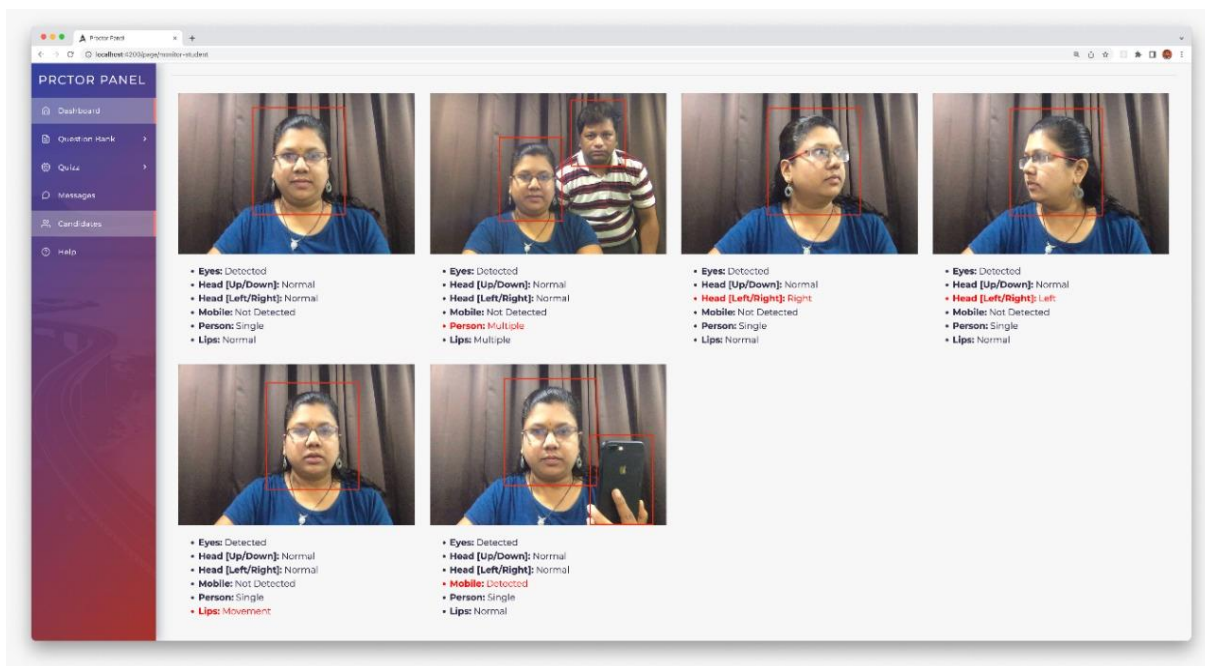


Figure 5- Results obtained for different situations

The paper demonstrates the capability to proctor candidates while taking their exams using different techniques and generating cheating incidents reports not to allow the student to take the exams. The system identifies the incidences of ill practicing. Image 1 shows the normal condition of appearing for examination and not objectionable. In second incidence the other person in the frame is identified. Whereas next three situations are looking at other places. Mobile like devices are detected and alert given to the examiner in the last frame. The project uses well known technologies like ReactJS, Bootstrap, Python, OpenCV, AI/ML for implementing various components.

V. REFERENCES

1. Mikel Labayen, Ricardo Vea, JuliánFlórez, (Member, Ieee), NaiaraAginako 3, And Basilio Sierra 3 “Online Student Authentication And Proctoring System Based On Multimodal Biometrics Technology” 2019 IEEE Access
2. Vishnu Raj R S, Athi Narayanan, Kamal Bijlani “Heuristic-Based Automatic Online Proctoring System” 2015 IEEE 15th International Conference On Advanced Learning Technologies
3. Abdul WahabMuzaffar, Muhammad Tahir, Muhammad Waseem Anwar, QaiserChaudry, Shamaila Rasheed Mir, And Yawar Rasheed “A Systematic Review Of Online Exams Solutions In E-Learning: Techniques, Tools, And Global Adoption”
4. Swathi Prathish, Athi Narayanan S, Kamal Bijlani “An Intelligent System For Online Exam Monitoring” 2016 international conference on Information Science(ICIS), IEEE

5. Samuel S. Chua, Joshuel B. Bondad, Zechariah R. Lumapas, Joven DL. Garcia "Online Examination System with Cheating Prevention Using Question Bank Randomization and Tab Locking"
6. Hadian S. G. Asep and Y. Bandung, "A Design of Continuous User Verification for Online Exam Proctoring on M-Learning," International Conference on Electrical Engineering and Informatics (ICEEI), Bandung, Indonesia, 2019.
7. S. Sawhney, K. Kacker, S. Jain, S. N. Singh and R. Garg, "Real-time smart attendance system using face recognition techniques", Proc. 9th Int. Conf. Cloud Comput. Data Sci. Eng. (Confluence), pp. 522-525, Jan. 2019.
8. A. Ullah, H. Xiao and T. Barker, "A dynamic profile questions approach to mitigate impersonation in online examinations", J. Grid Comput., vol. 17, no. 2, pp. 209-223, Jun. 2019.
9. S. Zhang, X. Zhu, Z. Lei, H. Shi, X. Wang, and S. Z. Li, "FaceBoxes: A CPU real-time face detector with high accuracy," in Proc. IEEE Int. Joint Conf. Biometrics (IJCB), Oct. 2017
10. F. Schroff, D. Kalenichenko, and J. Philbin, "FaceNet: A unified embedding for face recognition and clustering," in Proc. IEEE Conf. Comput. Vis. Pattern Recognit. (CVPR), Jun. 2015.
11. Deep Neural Network Models for the Prediction of the Aggregate Base Course Compaction Parameters by Kareem Othman Designs 2021, 5(4), 78; <https://doi.org/10.3390/designs5040078>
12. Towards Contactless Learning Activities during Pandemics Using Autonomous Service Robots by Anas Al Tarabsheh, Maha Yaghi, AbdulRehman Younis, Razib Sarker, Sherif Moussa, Yazeed Eldigair, Hassan Hajjdiab, Ayman El-Bazand Mohammed Ghazal Appl. Sci. 2019, 11(21), 10449; <https://doi.org/10.3390/app112110449>
13. E-Assessment in E-Learning Degrees: Comparison vs. Face-to-Face Assessment through Perceived Stress and Academic Performance in a Longitudinal Study by Roberto Sánchez-Cabrero, Javier Casado-Pérez, Amaya Arigita-García, Elena Zubiaurre-Ibáñez, David Gil-Pareja and Ana Sánchez-Rico Appl. Sci. 2019, 11(16), 7664; <https://doi.org/10.3390/app11167664>
14. Preferences and Scores of Different Types of Exams during COVID-19 Pandemic in Faculty of Veterinary Medicine in Spain: A Cross-Sectional Study of Paper and E-exams by Pablo-Jesús Marín García, Alberto Arnau-Bonachera and Lola Llobat Educ. Sci. 2019, 11(8), 386; <https://doi.org/10.3390/educsci11080386>
15. Implementation of E-Proctoring in Online Teaching: A Study about Motivational Factors by Carina S. González-González, Alfonso Infante-Moro and Juan C. Infante-Moro Sustainability 2018, 12(8), 3488; <https://doi.org/10.3390/su12083488>
16. Take-Home Exams in Higher Education: A Systematic Review by Lars Bengtsson Educ. Sci. 2019, 9(4), 267; <https://doi.org/10.3390/educsci9040267>
17. M.M. Sardeshmukh, M.T. Kolte, and D.S. Chaudhari "Activity Recognition Using Multiple Features, Subspaces and Classifiers" Lecture Notes in Computer Science (including

- subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), Springer International Publishing Switzerland 2013, ISBN978-3-319-03755-4
18. Sardeshmukh, M.M., Kolte, M., Joshi, V, "Performance analysis of human detection and tracking system in changing illumination" Advances in Intelligent Systems and Computing, Springer International Publishing AG 2016, ISBN978-3-319-47952-1, DOI https://doi.org/10.1007/978-3-319-47952-1_8 pp.99-109
 19. Tamboli, N., Sardeshmukh, M.M, "Facial Based Attendance Monitoring System Using Discriminative Robust Local Binary Pattern, 2017 International Conference on Computing, Communication, Control and Automation, ICCUBEA 2017
 20. Khirodkar, V., Saha, R., Sardeshmukh, M.M., Borse, R., "Employing minimum distance classifier for emotion recognition analysis using EEG signals", 2017 International Conference on Computing, Communication, Control and Automation, ICCUBEA 2017
 21. Kazi K. S., "Significance And Usage Of Face Recognition System", Scholarly Journal For Humanity Science And English Language, 2017, Vol 4, Issue 20, pp 4764-4772.
 22. Miss. A. J. Dixit, et al, "Iris Recognition by Daugman's Method", International Journal of Latest Technology in Engineering, Management & Applied Science, 2015, Vol 4, Issue 6, pp 90-93.
 23. KutubuddinKazi, "Lassar Methodology for Network Intrusion Detection", Scholarly Research Journal for Humanity science and English Language, 2017, Vol 4, Issue 24, pp.6853-6861.
 24. Ms. YogitaShirdale, et al, "Analysis and design of Capacitive coupled wideband Microstrip antenna in C and X band: A Survey", Journal GSD-International society for green, Sustainable Engineering and Management, 2014, Vol 1, issue 15, pp. 1-7.
 25. Ms. ShwetaNagare, et al., "Different Segmentation Techniques for brain tumor detection: A Survey", MM- International society for green, Sustainable Engineering and Management, 2014, Vol 1, issue 14, pp.29-35.
 26. Miss. A. J. Dixit, et al, "A Review paper on Iris Recognition", Journal GSD International society for green, Sustainable Engineering and Management, 2014, Vol 1, issue 14, pp. 71-81.
 27. Ms. ShwetaNagare, et al., "An Efficient Algorithm brain tumor detection based on Segmentation and Thresholding", Journal of Management in Manufacturing and services, 2015, Vol 2, issue 17, pp.19-27.
 28. Miss. A. J. Dixit, et al, "Iris Recognition by Daugman's Algorithm – an Efficient Approach", Journal of applied Research and Social Sciences, 2015, Vol 2, issue 14, pp. 1-4.
 29. Kazi K. S., "Face Recognition based on Principal Component Analysis and Feed Forward Neural Network", National Conference on Emerging trends in Engineering, Technology, Architecture, 2010, pp. 250-253.
 30. A. O. Mulani, "Secure and area efficient implementation of digital image watermarking on reconfigurable platform", 2014, In: International conference on smart structures and systems.

31. A. O. Mulani et al , “Watermarking and Cryptography based image Authentication on reconfigurable platform”, Bulletin of electrical engineering and informatics, 2017, vol 6, issue 2, pp. 181-187
32. P R Kulkarni, et al, “Robust invisible digital image watermarking using discrete wavelet Transform”, IJERT, 2015, Vol 4, Issue 1
33. A. O. Mulani, “Secure and area efficient implementation of digital image watermarking on reconfigurable platform”, 2014, In: International conference on smart structures and systems.
34. A. O. Mulani et al , “Watermarking and Cryptography based image Authentication on reconfigurable platform”, Bulletin of electrical engineering and informatics, 2017, vol 6, issue 2, pp. 181-187
35. P R Kulkarni, et al, “Robust invisible digital image watermarking using discrete wavelet Transform”, IJERT, 2015, Vol 4, Issue 1
36. Rahul S Shinde, et al, “Analysis of Biomedical Image using Wevelet transform”, International journal of innovations in Engineering, research and Technology, 2015, vol 2, issue. 7, pp. 1-7
37. Mulani, Altaf O., and P. Mane. "Secure and area efficient implementation of digital image watermarking on reconfigurable platform." Int. J. Innov. Technol. Explor. Eng.(IJITEE) 8.2 (2018): 1.
38. Rahul G. Ghodake and A. O. Mulani, “Microcontroller Based Drip Irrigation System”, Techno-societal 2016, International conference on advanced technologies for societal applications, pp. 109–115.
39. AmrutaMandwale and A. O. Mulani, “Different Approaches For Implementation of Viterbi decoder”, IEEE International Conference on Pervasive Computing (ICPC), Jan. 2015.
40. AmrutaMandwale and A. O. Mulani, “Implementation of Convolutional Encoder & Different Approaches for Viterbi Decoder”, IEEE International Conference on Communications, Signal Processing Computing and Information technologies, Dec. 2014.
41. AmrutaMandwale and A. O. Mulani, “Implementation of High Speed Viterbi Decoder using FPGA”, International Journal of Engineering Research & Technology (IJERT), Feb. 2016
42. D. M. Korake and A. O. Mulani, “Design of Computer/Laptop Independent Data transfer system from one USB flash drive to another using ARM11 processor”, International Journal of Science, Engineering and Technology Research, 2016.
43. Rahul G. Ghodake and A. O. Mulani, “Sensor Based Automatic Drip Irrigation System”, Journal for Research, 53-56, 2016.