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Monitoring and Controlling Student's behavior in Online Education

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Abstract: - Distance Learning may lose monitoring the learning process such as lack of direct follow-up to the study on the website and the lack of direct communication with the trainer.

In this research the Authors will discuss multiple solutions that may help the governance of Distance Learning (DL) by using some of the available software solutions and modern technologies, such as AI and FURIA that help in achieving the goals in the research as an enhancement method of E-learning.

The results of the research reached by the authors were the possibility of monitoring the educational process of distance education using some modern technologies such as the FURIA algorithm and DLIB library, which enables face reading and analysis while maintaining privacy and security for the student, which helps to overcome weaknesses and increase confidence between the educational facility and the trainee, in addition to some Improvements that develop distance education on different educational platforms.

Keywords: Distance Learning (DL), Fuzzy Unordered Rule Induction Algorithm (FURIA), Learning Management System (LMS), electronic learning (E-learning), Modular object-oriented dynamic learning environment (Moodle), Gabor Wavelet (GW).

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1. Introduction

With the development of technology, distance education has become one of the basics in the educational process, simulating the traditional process in education, and even more effective due to the diversity of modern teaching methods and the absorption of the largest number of trainees. Distance education is one of the modern methods of education, and its basic concept depends on the learner's presence in a place that differs from the source that might be the book or the teacher. It is the transfer of an educational program from a certain educational institution to geographically different places. However, this type of education has challenges that affect the distance education process.

Distance education has become an important concept in education that led to the development of network learning concepts, connected learning spaces, concrete learning, and mixed learning systems to expand the scope and change the nature of distance education models to the web anytime, anywhere [1].

The DL obstacles previously were the extent to which people are familiar with technology, infrastructure readiness and credibility, and how to gain confidence in

several areas, including commercial and education. These obstacles have been overcome by following up process and ensuring that the trainee is serious in the educational process [2].However, the technical capabilities available for distance education are still a concern in education results due to its lack of an essential monitoring method, which ensures that the recipient interacts positively with the information, ensuring that it reaches as it was face to face.

The Figure (1) shows a digital system specifically designed to manage electronic courses and enable collaborative work between the teacher and the learner. This system manages all these aspects through the automation of learning management processes. The processes include displaying the course schedule, student registration, printing reports to evaluate the educational process outcomes, a list of students' names, and managing the process of entering students' grades, printing certificates, and displaying test results, as it is a system that helps to manage the educational process.

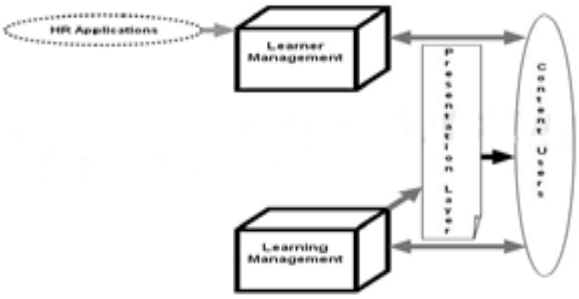


Figure 1. LMS

Some characteristics will be added to this system to be more effective during the educational process using modern techniques and algorithms that achieve continuous monitoring of the trainees in terms of presence and the extent of its benefit and absorption of the scientific material presented remotely and to determine the difference of levels between the trainees.

2. Related Work

Many studies are available to examine changes in the Online education environment associated with the widespread use of distance learning technologies. According to the Point of views of Chen, C., Yang, J., Tang, X., Song, N., & Lu, J. (2019, June) they proposed a creative method of distance education that gives the student a specific QR code when registering on the distance educational website, this code contains the student ID , the score of the training course and supported links to the course. The system records the trainee data that was created when the trainee was enrolled. The researcher claims this approach to increase the reliability and the efficiency of distance learning. However, this study is limited to storing the trainee data and verifying his identity while entering the distance education platform [3].

On other hand by He, W., Xu, G., & Kruck, S. E. (2019) they mentioned that online education is the most common and most demanding in educational institutions today, and this depends mainly on the trainer to design, develop, teaching and evaluating these training programs with maximum efficiency to suit the training environment and to make them more beneficial to the trainee and also depends on the good knowledge of the teacher in the technique used in distance education .The researcher added that the methods of distance education still need a lot of studies that must be done to improve the quality of education via the Internet using modern technical methods [4].

In the study done by Estacio, R. R., & Raga Jr, R. C. (2017), the researchers collected data obtained from different educational levels to be analyzed, conducted on the students and compared them to the level of their activities in distance education using a specific algorithm. After collecting these records and measuring them in a numerical value that gives a visualization of the level of students, this study can help trainers monitoring students and enabling them to quickly and distinctly identify outstanding students and also the level of each individual student, Also the researchers extracted graphs showing the extent of student interaction and measuring their performance using digital analysis by working to further develop an interface that teachers can use [5].

In this research paper entitled (Distance Learning and Learning Management Systems) by Cavus, N. (2015) ,with the advancement of technology, it was necessary to meet the change of the concept of time and space to encourage self-study to give an overview of technical systems used in distance education, so the study focused on Learning Management System [LMS] education will enables teachers to monitor the student and follow up his education , tests, and methods of communication between teacher and student, Also provides some other features such as student guidance and interactive applications which are needed recently due to the increasing number of students in education and the multiplicity of methods of interaction [6].
The study by Pardo, A., Han, F., & Ellis, R. A. (2016) is based on the academic prediction of students in distance education according to complex algorithms designed to provide targeted educational guidance and to determine the level of student performance. This study helped to access a report on monitoring student participation in e-learning as

well as general guidelines on effective educational strategies in distance education. by a set of indicators, such as student participation, academic performance, and academic results, and also the students are participating in research, assignments, questions, videos, and documents in electronic form [7].

Modern Distance Learning Technologies in Higher Education: Introduction Problems study focuses on the modern educational environment, where distance learning's success depends largely on teachers, and on the effectiveness of online education, and the reference to time factors and technical problems. However, it should be taken into account that the Internet's modern needs must be taken into account. And regular evaluation of the Internet determines the quality of distance education, and the study was based on a survey to determine students' attitudes towards distance learning. The request was asked whether they like learning using online training courses, and 90% of the participants answered positively, arguing that they can learn any topic at any time. Almost all students (95.6%) rated the effectiveness of using e-courses positively. They indicated that the advantage of this training is that there is ample opportunity to learn materials and perform tasks anywhere and at any free time. Students noticed various assessment materials in e-courses: tests, problems, creative assignments or case studies, online group projects, and articles. As for the quality of distance learning, students have demonstrated advantages and disadvantages: 85.14% of students note distance learning availability as an advantage. One can learn any electronic course anywhere with any electronic device connected to the Internet. The psychological aspect of learning with a distance course is also important for students. At this point, 57.01% of participants experienced an anxiety reduction when performing control tasks. The main deficiencies of distance learning are the lack of full communication with teachers and colleagues. Students (about 44% - 541 students) said that the lack of skills required to deal with online computer-based learning, which is a problem that hinders students from reaching their main objective. As for the positive aspects, almost all of the participants indicated an opportunity to expand their space (89.7% - 1103) and save their free time (80.9% - 995 students). The answers also showed that the most common concerns regarding distance education are concerns regarding the inability to interact with faculty and teachers (55.3% - 680 students) and the inability to research; therefore, participants also indicated that there are no enough academic advisors. Despite this, this study focused largely on the educational environment and the quality of education without addressing how to improve the quality of education, whether by monitoring methods or introducing any technology that improves the quality of education. However, the educational environment is the main aspect that we always seek to develop [8].

A fuzzy logic approach to reliable real-time recognition of facial emotions on this paper introduces a method for the classification of facial expressions based on a fuzzy logic model. The approach relies on the supervised machine learning method, which uses a pre-existing database that contains images of faces labelled with their respective emotions. A set of fuzzy logic rules are generated from the given data using the FURIA algorithm. These rules are generated based on the most important triangles' cosine values plotted on the most important points on a face. Each of the generated fuzzy rules presents some conditions, which are then used to classify different emotion types. To start the emotion recognition, first, a face must be detected. For this task, the DLIB toolkit was used for real-time face tracking and provide a set of 68 landmarks from the face detected. Some triangles are then overplayed over these points, and the cosine value is calculated for all the triangles' vertices. The values are later passed to the generated fuzzy rules to recognize the image's emotions [9].

Paper titled Emotion recognition based on facial components suggests a way for emotion recognition based on facial components. It is based on extracting the local features of mouth and eye from each frame using GW with selected orientations and scales. That features will be applied on classifier for detecting of the face scope. From detection, each pixel on through the face [10]. Finally, select and recognize the emotion of the face using the Adaboost algorithm as shown in figure (2)

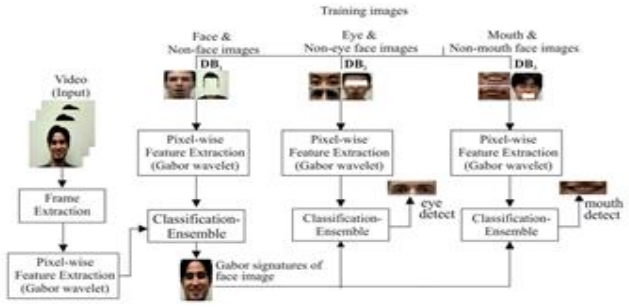


Figure 2: Emotion recognition based on facial components

3. Methodology

The proposed system will provide various solutions that can help in management eLearning through monitoring students by using some of the available software solutions and modern technologies, such as AI and DLIB Library, that help in achieving these goals.

The proposed system will monitor the student during the Distance Learning (DL) using a set of modern technical methods that attract the student's attention and force him to follow and focus, such as using face recognition technology and direct interaction between the student and the instructor during the electronic education process using FURIA algorithm that reads facial expressions. The proposed system is based on three main stakeholders as Shown in figure (3).

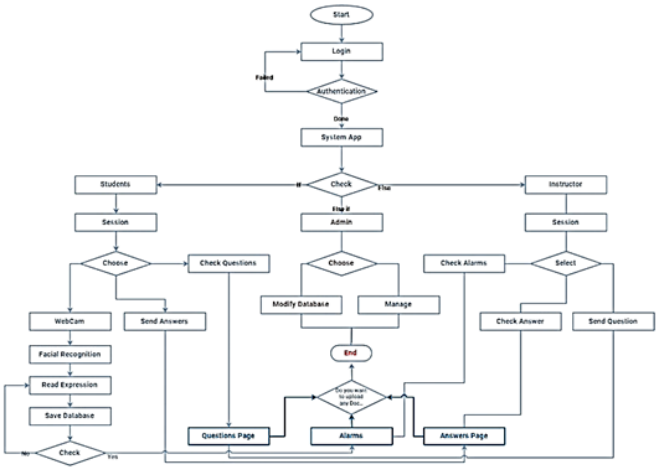


Figure 3. System Flowchart

Figure (4) shows a block diagram of the proposed system, which consists of two main sections. The first one is the detection, which includes two phases (collection and analysis), and the second one is responses, which include (escalation and action). Start to explain the first section, which contains collection data from various resources such as student's data, face recognition, and instructor's data. This data will be analysed in the following phase to provides more detailed data like (Facial Expression, check alarms, and Questions & answers). In the second section, we need to process and store data extracted from section one. Through the Escalation phase, we prepared questions by instructors, received answers from the student, and saved the whole information to the database. The final step presents different actions that will be applied based on information extracted from the previous phase, such as informing the instructor, sending answers, and motivating students.

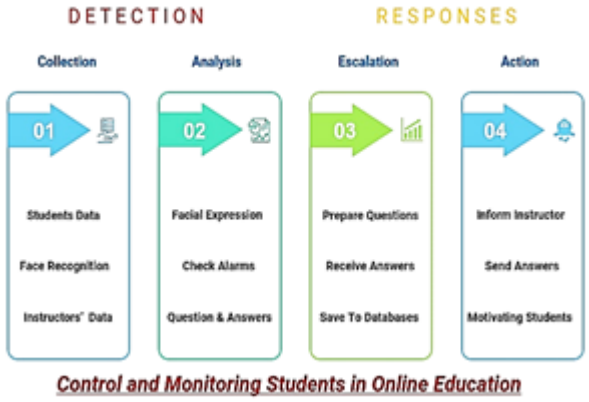


Figure 4: Block diagram for the proposed system

The system consists of stakeholders who interact with the system. Every stakeholder must associate with all operations executed through him, as shown in Figure (5).

Figure 5: Use case for the proposed system

Project Tools:

The following points view the tools that will be used in the proposed system.

Software Tools:

• Microsoft Visual Studio 2019: It is the main integrated development environment from Microsoft. It enables the graphical user interface programming and scripts and Windows Form, websites, web applications, and web services supported by Microsoft Windows, Windows Mobile, .NET Framework, and Microsoft Silverlight.

• DLIB: It is a modern toolkit that contains algorithms and machine learning tools to create complex programs in the C # language to solve real-world problems.

They will be used in the system in the process of face recognition, analysis, and processing.

• MYSQL Database: It is a relational database management system that depends on the SQL language. It is an open source product. Fast and multi-threaded database server making the ability to query the database very fast; It is characterized by the ease of linking its tables to the user interface that is designed in different programming languages. It will be used to store, manage, and connect the system data.

• Microsoft Excel: Microsoft Office Excel is a program used to create spread sheets, lists, budgets, and charts. Excel is useful for processing data and may be used for advanced mathematical operations. It will be used in the proposed system to test some data before storing it to the MySQL database.

• FURIA Rules: FURIA (Fuzzy Unordered Rule Induction Algorithm): An algorithm for the classification of facial expressions based on a fuzzy logic model. The approach relies on a supervised machine learning method that uses pre-existing databases that contain images of faces labelled with their respective emotions. A set of fuzzy logic rules are generated from the given data, using the FURIA algorithm. These rules are generated based on the cosine values of the most important triangles plotted on the most important points on a face. Each of the generated fuzzy rules presents some conditions, which are then used to classify different emotion types.

• Visual Paradigm\Edraw max: Open source-modelling tool and it is used to draw UML diagram.

Hardware Tools:

• Laptop or desktop device with the following minimum requirements:

- ❖ RAM (Minimum RAM of 4 GB).
- ❖ Processor Cores (Minimum of a 4 Core processor).
- ❖ Processor Speed GHZ (Minimum processor speed of 2 GHZ).

• RGB Camera\webcam:

- ❖ With high features to be fit with FURIA algorithm and reduce errors.

• Database:

- ❖ As a warehouse to store training dataset of FURIA algorithm.

4. Results and Discussion

Test Cases:

A test case is a set of conditions or variables as shown below in table 1 throuh which a tester will define whether a system under test satisfies requirements or works accurately. The process of improved test cases can also support findings problems in an application's requirements or design.

Table 1:Features to be test in this paper

ID	Item Being Tested
1	Reading Face Expressions.
2	Sending Alerts to Instructor.
3	Sending Questions from Instructor to Students.
4	Receiving Questions from Instructor onto Student Page.
5	Sending Answers from Student to Instructor.
6	Receiving Answers from Students onto Instructor Page.

1- Reading Face Expressions:

The main test case of the proposed system is reading the facial expressions of students. This part will contain an explanation about this test case. Data needed in the face of a student and FURIA algorithm will be starting an analysis of faces when the student joins to the classroom as shown in figure (6).

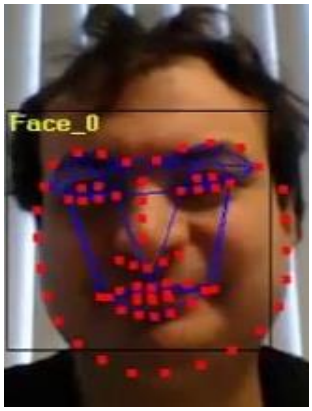
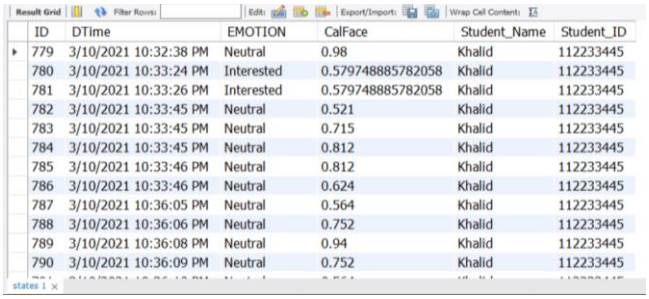


Figure 6: Analyzing the faces using(FURIA)

After that, the system will save the algorithm's result in the database with extra information about the student (StudentID – Student Name), in addition to that, the time in which the expression happened. Next figure show the part of the database where the data will be saved as shown in figure(7).



ID	DTime	EMOTION	CalFace	Student_Name	Student_ID
779	3/10/2021 10:32:38 PM	Neutral	0.98	Khalid	112233445
780	3/10/2021 10:33:24 PM	Interested	0.579748885782058	Khalid	112233445
781	3/10/2021 10:33:26 PM	Interested	0.579748885782058	Khalid	112233445
782	3/10/2021 10:33:45 PM	Neutral	0.521	Khalid	112233445
783	3/10/2021 10:33:45 PM	Neutral	0.715	Khalid	112233445
784	3/10/2021 10:33:45 PM	Neutral	0.812	Khalid	112233445
785	3/10/2021 10:33:46 PM	Neutral	0.812	Khalid	112233445
786	3/10/2021 10:33:46 PM	Neutral	0.624	Khalid	112233445
787	3/10/2021 10:36:05 PM	Neutral	0.564	Khalid	112233445
788	3/10/2021 10:36:06 PM	Neutral	0.752	Khalid	112233445
789	3/10/2021 10:36:08 PM	Neutral	0.94	Khalid	112233445
790	3/10/2021 10:36:09 PM	Neutral	0.752	Khalid	112233445

Figure 7: Face expressions table

2- Sending Questions from Instructor to Students:

The second test case is sending questions from the instructor to the student after receiving the system's alerts. There is part of the system that will be responsible for the instructor page work to observe the database and will send a warning to the instructor when the expression "Uninterested" happened, as shown in figure (8).

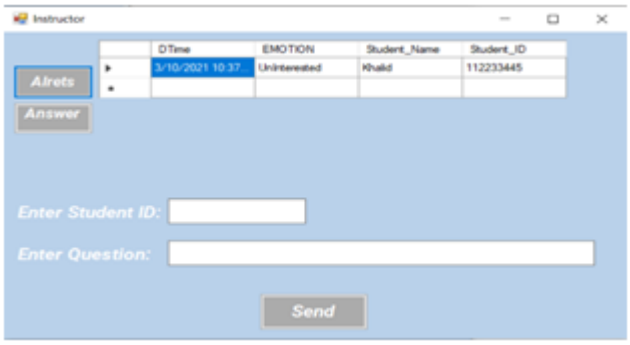


Figure 8: Sending alerts to instructor

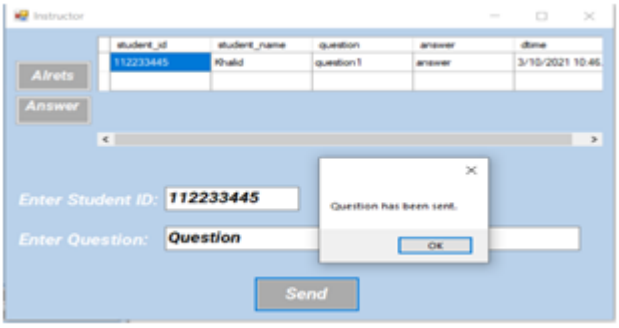


Figure 9: Send question to student

3- Receiving Questions from Instructor to Student Page:

The third test case is the process of receiving the question and shows it on the student page. After sending the question process, the question will be saved in the database. Some parts of the program responsible for fetching questions from a database and showing them in a table on the student page. Figure 10 shows the process of receiving a question from the instructor onto the student page.

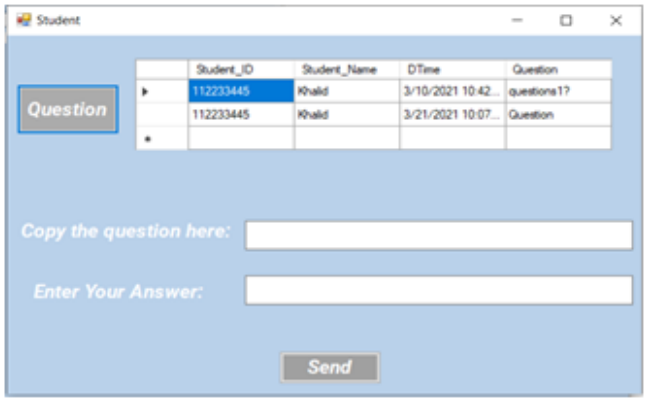


Figure 10: Part of database where the question will be saved

4- Sending Answers from Student to Instructor:

The student, in his turn, will select the question that he received from the instructor and write an appropriate answer and resend it to the instructor. After that, the system will alert the student through the message box to tell him that his answer has been sent correctly. Figure below shows the process of sending answers from student to instructor as shown in figure (11).

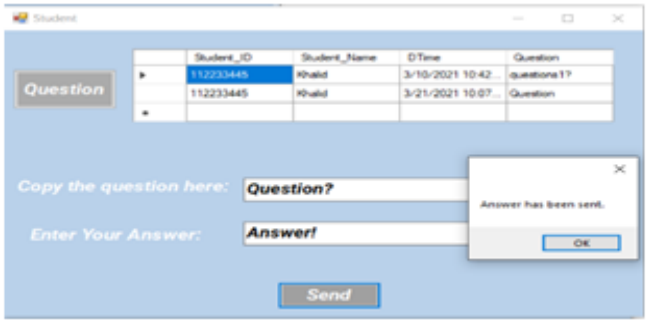


Figure 11: send question to instructor.

The student answers will be saved in a table in the database where the instructor can check them during or after finishing his class.

5- Receiving Answers from Students onto Instructor Page:

After saving the answers process on a database, the instructor can review the answers by showing them in a table

on his page during or after finishing the class as shown in figure (12).

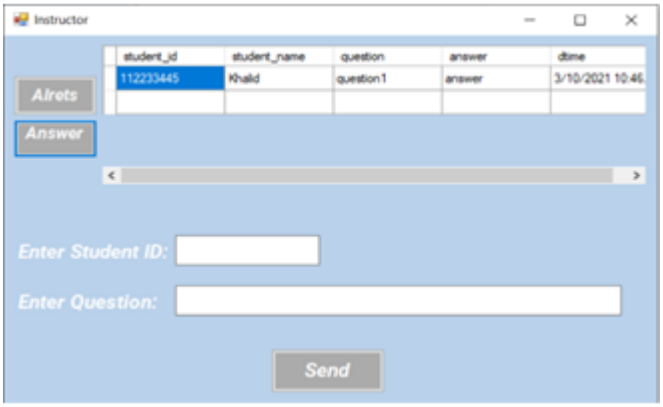


Figure 12: Student answers table on instructor page

5. Conclusion and Future Scope

In the proposed system, the authors summarized the great importance of using a computer and its tools in the learning process and mentioned the advantages of using E-Learning and why it is needed to use the internet in the learning process. But although these advantages exist, Distance Learning may lose control and monitoring of the learning process because of several factors such as lack of supervision and a direct follow-up to the website's study activities and the lack of direct communication with the trainer. A list of previous papers had been studied and summarized with the extraction of the main features and finally, the list of the strength and weak points had been discussed. To overcome these weaknesses, the proposed system uses a set of modern technical methods such as machine learning and deep learning that would improve the electronic educational process. Finally, the authors focused on designing user interfaces for the proposed system and implementing almost all functions required by the system in addition to that, testing all cases and functionalities behind the proposed system to ensure that all features are working correctly.

There are plenty of improvements that could be done in order to achieve better results. In future work, the authors will try to add more features to the proposed system in addition to running the system, testing it in real-life, and applying it to various e-learning platforms.

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