Development of examination software for the Faculty of Medicine

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Abstract — the article discusses in detail several problematic issues that occur in the Faculty of Medicine and their examination since they need a different, specific and properly equipped environment from all other faculty students to pass the exams. Because of that, a methodology adapted to students and appropriate software is needed. The article discusses in detail the ways to eliminate the mentioned problems and talks about the solutions that we offer to the Faculty of Medicine. The article also focuses on the methods of using software and hardware, their advantages and the effect that a new and well-functioning system will have on the students of the Faculty of Medicine. The article also shows the examples of the examination systems of medical universities from foreign countries, the similar approaches that have been tested in the world and that we are going to implement To make the exams as student-oriented as possible.

Keywords — informatics, software development, examination software, software for the Faculty of Medicine.

I. INTRODUCTION

Medicine is one of the most specific fields where making a mistake is equal to death, therefore it is necessary to provide students with the appropriate knowledge, skills, and experience. In addition, it is important to create an examination space that is properly adapted to them, which will be focused on the fact that students can demonstrate their knowledge as much as possible.

Exams for medical students differ from standard exams for students of other faculties because they use the principle of "OSCE" (Objective Structured Clinical Examination). This means that students have the opportunity to demonstrate their knowledge and skills in specially designed simulation rooms, where the environment is as close as possible to diagnostic cabinets. To put it simply, there are twelve rooms located next to each other, divided in the middle by a wall and transparent glass on one side. The first side of the room belongs to the examiner and the second to the student. In each room, students perform certain types of medical tasks within a limited time frame, after the time is up, they are required to move to another room to complete the next task. These types of exams are important in that medical situations are as close as possible to real cases and students have the opportunity to use their skills and theoretical knowledge in practice to be able to save the lives of patients. Using the „OSCE" principle during exams is a very important step forward for medical students. However, without its specific automation, it requires a lot of human resources and time. Because of that, we had a dialogue with various universities, where we talked about the challenges and problems of the „OSCE" principle.

At this meeting, the University of Georgia expressed its desire to participate and update the examination system of its medical school. UG (University of Georgia) also expressed its willingness to share with us all the problematic issues related to this. With joint efforts, we would be able to improve the system to the maximum and adapt it to the students.

II. ABOUT PROBLEM

The problems were discussed with the University of Georgia. Following flows were seen: the examination rooms were not equipped with the appropriate software and inventory, which subsequently created several problematic issues.

In particular, the examiner had to share the image with one laptop to twenty-four monitors via an HDMI HUB, which meant that the same information was displayed on all monitors. This created a big problem because it was not clear to the students which room they should have entered after finishing the exam in one exam room to continue the exam. Using a consumer, non-specific laptop also created a high risk of the system getting stuck, having a bug that would cause the exam to fail. In the case when the observer wanted to see some kind of information on the laptop, the students would also be able to see it on the monitors. Using a consumer, non-specific laptop also created a high risk of the system getting stuck, having a bug that would cause the subsequent test to fail. In the case when the observer wanted to see some kind of information on the laptop, the students would also see it on the monitors. One of the problems was the lack of exam software, which was reflected in the following: examiners had to prepare Excel files before each exam and save them on each exam room's computer, which would outline the assessment system and exam questions. Each Excel file should have had as many Sheets as students are taking the exam. Creating the said Excel file from scratch and filling in the information before each exam was quite tiring and uncomfortable. Moreover, if something unexpected happened and the Excel file was not saved, all the information would be deleted. Guest lecturers who observed the exam had to manually write the badge numbers of the students who entered the exam room in their Excel file, which increased the probability of making a mechanical error since the examiner could write down the student's badge number incorrectly, which would subsequently cause the student to be left without a score. The examiners entered the scores into an Excel file, which required extra work from the examiners as they had to extract the Excel file from each computer separately, view the grades, and then display it on the student portal and compile tables to see the students' average scores.

Similar technologies - the "OSCE" principle is used by 57 countries worldwide, including America, UK Britain, France

and Germany[1]. The mentioned principle is similar in all countries, although the method of conducting is different.

Imam Abdulrahman Bin Faisal University uses "QuestionPro" software. This means that the traditional paper-based stations were converted into an online electronic version. Answers were filled in using smart tablets (iPads). QR codes were used for students' identification at each station to fully digitize the process and save time. To create and distribute surveys, they use "QuestionPro", which is web-based software. It consists of tools for distributing surveys via email or website, an interface for creating survey questions, and tools for analyzing and viewing the results[2].

In UK Britain, the University of Northampton University of Northampton uses an electronic examination system for medical students, which means that a timing system and cameras[3] are installed in each simulated examination room.

III. SOLUTION OF THE PROBLEM

To make the "OSCE" principle more practical and convenient, both hardware and software are needed. A web application was created for which the following technologies and hardware were used.
Software:

- React Js[4] – web frontend;
- Spring Boot[5] – web backend;
- Android SDK and Kotlin[6] – for Android applications;
- Redis[7] – for cashing and saving sessions;
- PostgreSql[8] – for collecting data;
- Docker[9] – for virtualization.
  hardware provision:
- Server PC - to run the system;
- 27-inch monitor - so that students can control the time on the monitor;
- Android box - android 8.0 + - so that the exam supervisors can display the exam time in live mode;
- Poe Tablet - android 8.0+ - so that students can register their badges. Also, the mentioned tablet allows you to control the exam time from outside without entering the exam room. PoE will be used for simple infrastructure, in particular, it will no longer be necessary to use an additional power cable;
- Poe switch lyer_3 - to supply the tablet with both electricity and network. Layer 3 will be responsible for the internal network even if the router goes down.

Through the web application, exam administrators can control who has access to the exam software and assign appropriate rights and roles. They also can compile exam questions for students and track the progress of the exam time. Exam supervisors can view students' grades, and averages in the form of charts and tables through the web application, which they can then transfer to an Excel file. Using the application, it is possible to create a reminder in the calendar, which allows us to remind relevant persons of specific information before a certain time. As soon as the student enters the exam room, the examiner will automatically see the student's code, picture, exam questions, and grading system. In the case when the examiner cannot evaluate the student on time, he is not limited in time and can write the appropriate score and comment to the student later. The application

mentioned above can be used from any device that has browser support.

IV. CONCLUSION

In conclusion, we can say that it is important for the students of the Faculty of Medicine and the supervisors of the exam to have a well-organized exam system, which will be focused on the quality, efficiency and proper conduct of the exam. The advantages of our application are as follows: The architectural infrastructure is more accurate, usable and result-oriented than the old one; The time management system has become more efficient since it became possible to manage time from any device that supports a browser; It is no longer necessary to work in separate Excel files since the performance of the mentioned function (compilation of exam questions, a reflection of marks, analysis of obtained marks, entering of student badge numbers) was added to the software provision and thus we achieved time-saving, reduction of staff labor, more accuracy and in a short time as much as possible Conducting exams for more students than before. Based on all of the above, we can say that our application is a very flexible and effective tool that will simplify the work process for both the exam supervisors and the students so that they can realize their knowledge as much as possible during the exam.

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