



SPRINGEXTRACTOR APPLICATION FOR WORK REVIEW AUTOMATION

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Abstract:

Modern times go hand in hand with the technology – every day we meet a lot of new modern smart gadgets. Consequentially, the need for IT experts is enormous. To meet the needs of the market, it is necessary to educate competent professionals. Increase in number of students majoring in electrical and computing sciences, as well as software and IT engineering confirm that the interest for making it in the IT sector is extremely big.

Rise in number of students created a problem related to the evaluation of knowledge. Tests, written and oral exams, homework assignments and projects are organized in order to check student's knowledge. Every one of these needs to be revised – teaching staff are met with an exponentially growing amount of work and time spent to finish the job of evaluating students correctly and objectively in the given timeframe. Teachers are under more stress, so the risk of an error is bigger as well. To solve this problem, minimize it and overcome it better, it's been worked on a proof of concept (semi) automated software that would be used for revising student work. The goal is to create a tool that would be fairly easy to use and efficient enough in solving given problem. At this point in time, we are implementing the concept of a web application (*SpringExtractor*) which will automate (partially in the beginning, and in later versions fully) the process of revising and evaluating student work. In this research, following concepts will be explained: motives and essential concepts of technologies planned for the realization, architectural organization, as well as potential points of expansion and improvement for the initially planned functionalities of the software.

Keywords:

work revising process, *SpringExtractor*, automatization, *Java*, databases.

INTRODUCTION

Software products used for solving different problems of high abstraction and complexity gradually take precedence – there is a growing need for platforms that would enable process automatization and optimization. Taking into consideration problems of the modern society, it is necessary to create a safe software which would satisfy given criteria.

As computers reached the peak of performance and process power, with the evolutive progress that can be seen in their programmability and the possibility of processing enormous amount of data, it is now possible to integrate them into almost every sphere of modern day.

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Development of sophisticated platforms is getting more and more dominant thanks to the trend.

In order to implement an automatization application which would eliminate the human factor in the repetitive parts of work that would furthermore drastically reduce human error caused by manual execution, some thought should be given to the way of possible realization of the software. About that, it would be also be good to consider web-oriented applications. Comparing web applications to the console ones, there is a certain advantage in the fact that the user interface is more intuitive, there is no need for the extensive training which needs to ante-date using the application. Web based software put more attention to security (security in the electronic and other ways of business plays a big part in today's time), which presents a additional advantage.

There is a number of challenges that the teaching staff is facing. First and foremost, there is a central problem of this research which consists of revising student work process that needs to be attended to in the beginning. The gap between time allocated for the evaluation and the number of students that need to be graded is getting bigger and bigger. This is directly consequential to the rising number of students enrolling into IT colleges. In order to unburden the teachers to a certain degree, an idea was born of developing a software which would be able to download all student exams, create a table with grades and enter personal information about each student that attended said exam. Doing this would partially automate the process of grading student work, and reduce the number of errors caused by humans.

Pandemic of COVID-19 affected almost every aspect of life, among which is the area of education. This new situation influenced the introduction of a new type of schooling which was, until that moment, not usual in the Republic of Serbia – online schooling. Schooling which was performed on numerous online teaching platforms also implied provided teaching units, but in a somewhat different way. With the regards of changing the teaching regime, verification of students and evaluation of their work had to also be realized in a proper manner. Therefore, no matter if we are talking about the classic education model, online model or some combination these to in order to implement the teaching process, there is still a problem of validation and grading of student work. That is why the idea of development of a software tool for automatization part of the grading student work process is getting more and more thought about and is gradually getting to the implementation consideration, details of which will be further explained in this paper.

2. MAIN CAUSE FOR THE APPLICATION DEVELOPMENT

Previously explained problem in the teaching process has been around in quite some time. Consideration of the way in which it could be solved lead to the conclusion that the need of hiring teaching staff becomes less important, that it requires less effort and time, while also making the whole process of evaluation simpler and more resistant to unintentional error.

There was a lot of work considering solving the problems of student grading in the past period. This brought initial conceptual solutions to light. Shortcomings to these solutions are contained the complexity of usage the tool, as well as the fact that manipulating the software meant that the user went through advanced IT training (it is expected that they will be able to singlehandedly configure, and later correctly use the framework that the platform provides). Based on that, we come to the conclusion that automatization, beside paying attention to solving the problem by sacrificing effort and time, need to take into consideration ease of use.

Only a few competent professionals engaged in the topics of introducing automatization in the education sector. There were even some ideas in some scientific papers that artificial intelligence could be incorporated in the solution. Also, this potential solution could be based on the software predictions about which future occupation (based on propensity tests) the student might choose.

„Artificial intelligence, automation and work“ [1] is an example of the paper which discusses usage of artificial intelligence and machine learning to automate repetitive parts of the work. In this case, elimination of human error would mean training the neural network. The network would afterwards be able to, using adequate training set, come to the conclusion on how it should process given set of data (student exams that need to be graded). In this case the advantage of introducing the concept of automatization could be seen in increasement of productivity, as well as reducing the number of errors. Core shortcoming of this approach would manifest in overly automating stuff – some parts of the work should still be trusted to be done by humans.

A representative example of the second scientific paper that dealt with the problem of introducing automatization in educational system is the paper named „The Benefits and Generic Procedure of Automating and Academic Student System in Primary and Secondary Schools as an Impetus for Educational Technology“ [2].



The paper is based on analysis of an idea of a software tool whose purpose would be to download student exams and prepare them for grading. The platform would later would require a teacher to log in, after which the data would be available for evaluating. The process of evaluating and grading exams would still have to be done manually, which furthermore means that the serious problem of the gap between the number of exams that need grading and the number of available teachers. This approach would mean automatization to a certain degree – once the grading is complete, results should be fed back to the software which would do automatic analysis and comparison of student grades. This means that the described process is not fully automated – pre-conditions for only automating crucial part of the systems have been created, while avoiding the potential overly used automatization.

While doing a detailed analysis of previous scientific papers, in combination with objective problem all of us at the faculty are facing, automatization has been stated to be a must-have functional requirement. Special attention must be paid in order for it not to become a cause of additional problems which would be of direct consequence of its overuse. *SpringExtractor* is a web application which represents a compromise of all previously stated – details of which functionalities shall be available and which users will be described in following chapter.

3. SOLUTION ARCHITECTURE

To work on development of software solutions which would integrate automatization concepts and teaching process needs setting up a quality starting point for future implementation of a software product which satisfies defined normative. As to make this application usable on a wider spectrum, we need to create a solid base which would later be a reference point from which future development could start, and later on also improved.

The platform used for automatization of student work evaluation process is still in development phase – architectural starting point that would allow all of the above is still being brainstormed. Concept mentioned in the following chapters represent crucial guidelines of the future implementations.

3.1. SYSTEM PARTICIPANTS

User (participant) of the system is defined as a subject whose need are being met by the implementing the software solution. In the case of the application which would support the teaching process from the student grading aspects, we will consider that the administrator, teaching staff and other unregistered users all have the role of a User.

User defined as a teacher has to be registered first, which is not the case with other Users. Teaching staff, before the administrator gives them the role of a teacher, has to perform the process of registration on the system and while doing so send a request for promotion to a higher rank. System administrator is a predefined User with special privileges – they have access to all parts of the application. Besides that, they can also accept or decline the request for promoting to the teacher role. This mean that the administrator is being in full control of the hierarchical control functions. All other types of Users are considered as unregistered users – students and other visitors (f/e faculty board members, potential freshmen etc). Use case diagram of system participants are represented on Figure 1, where the previously explained roles can be seen.

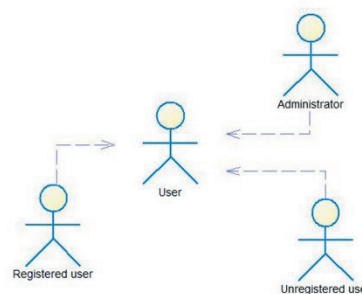


Figure 1 – Participants in the system

3.2. FUNCTIONAL SYSTEM REQUIREMENTS

It is an imperative to segregate participants and give specific access to all of the defined classification clusters in order to allow the system to support correct functionality division. For that reason, the idea is to make the software solution divided in three modules with available actions.

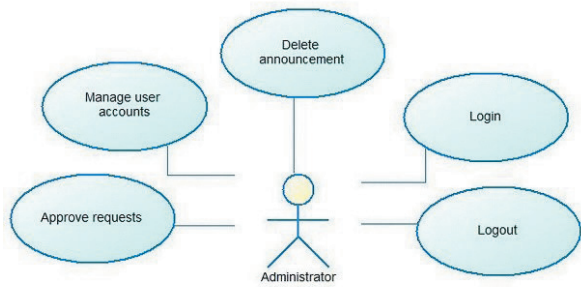


Figure 2 – Administrator module

Use case diagram for the administrator role is shown on Figure 2. First module is available exclusively to the administrator. Supported actions for the administrator are user registration on the system, manipulating of the user profiles (change of the registered users' information, activating/deactivating profiles and deletion of registered users), accepting/declining promotion requests for the roles of a teacher, removing news updates about a subject and logging off from the system.

Registered users that are teachers can, beside registration, log on and off the system, also do actions of personal information change, uploading collections of archived student work, uploading the grading scale, downloading machine-prepared archived and ready for the process of manual evaluation (in which is also the table for grade input), as well as creating news announcements for a subject (uploading grades in .pdf format). Registered user module, including its functionalities is shown on Figure 3.

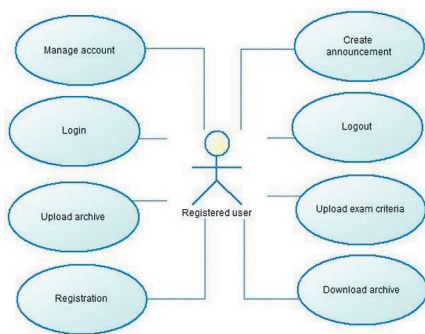


Figure 3 – Registered user

Unregistered users cannot log on the system, so advance options are unavailable - they are limited only to viewing uploaded news about a subject and downloading a PDF document that has student success on the previously performed knowledge evaluations. Allowed options are shown on Figure 4.

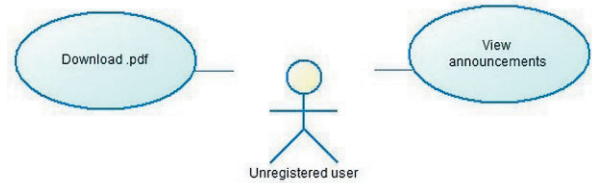


Figure 4 – Unregistered user

4. PLANNED TECHNOLOGIES FOR THE SOFTWARE SOLUTION DEVELOPMENT

The platform whose usage would be seen in automation of the repetitive parts of the verification and evaluation process of the submitted student work's implementation will be based on modern technologies from the web-oriented spectrum. Reason for this lies in advantage that is brought by web implemented solutions: ease of use of the concept that will be the base of solution implementation, access to adequate documentation which will help in removal of potential problematic places in the source code, easily understandable of the source code, adaptability to the future application updates, portability and creating client-server communication protocol.

Currently planned programming language is Java, with the assistance of Spring framework. Other technical requirements for this solution will mainly depend on Maven, application build tool. Java, Spring and Maven will be used for their numerous combined benefits. One of key guidelines for implementing the software product will be security as well, so the academic integrity will not be endangered (this might happen in cases where the application makes unauthorized access available).

Angular framework will handle the presentational layer viewed by system users. To make the visuals more intuitive and more understandable, we will use Bootstrap and SweetAlert libraries.

If the need for the additional frameworks, libraries dependencies and programming languages arise in any of the future iterations, we will be able to alter the application with minimal effort and modification, thanks to the fact that the platform will be created with pluggable modules.



5. CONCLUSION

With the educational system being a complex domain that requires software solutions to the repetitive parts of the work (with attention to the minimal error possibility), automatization can be used in this area. Usage area for the application for automatization of student work evaluation process will for now be limited to the cluster of programming courses in higher education facilities. The platform whose implementation is yet to come will secure less work for the teaching staff (tiring operations will be done by the applicative software), as well as reducing error occurrence.

On the basis of everything shown so far, it is evident that the need for this kind of automatization software is reaching its peak. There are numerous domain problems that the modern world is facing and that need maximal focus to solve. Some parts of the work can be performed without human assistance – they should be separated into a different domain area on which the software solution would work. Given this context, automatization would make sense and would be a tool that could help increase the working speed for the repetitive tasks, as well as increase productivity and accuracy. The process of solving the problems of modern society undeniably needs assistance of a human. To make sure that the work is done according to given criteria and principles, it is necessary to take care that the automatization is only implemented to a certain degree.

Therefore, the idea of introducing automation tools is justified, with the proviso that there must be a previously defined line of automation that must not be crossed.

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