Supporting dynamic, bi-directional presentation management in real-time

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Abstract

Nowadays university students grow up in a world where they receive real-time information via internet using their smart devices. The subscribed services are sending notifications continuously. Other necessary information are also only within 'one click' distance. So, a traditional lecture is outdated. Therefore, we need a more dynamic way of teaching as well. The modernization of university teaching methods is inescapable. For example, lectures should become more interactive in order to avoid emptying auditoriums. The dynamic, bi-directional conversation between the lecturer and a large number of students gives chance to utilize the available time the best in an effective way. For this purpose, the need is obvious for a real-time presentation management system and of course client units for the participants. Client units are given: the students bring their personal devices (phones, tablets laptops). (BYOD (bring your own device)) It is time to turn on this and to use it in our teaching practice as it has already been used by several leading universities. According to our surveys taken during the autumn of 2015, at about 95% of students of ELTE have personal smart devices so we are ready to use these facilities. We have created a prototype of a web-based real-time system, which could change a traditional talk into a dynamic, bi-directional one. In this system, teachers may ask questions during the lecture by sending it directly to attendee devices and then they receive the answers just in time, the same way as in case of a voting system. A more interesting point of view is that students may also ask questions during the presentation at any time but the decision whether to proceed or to stop remains at the lecturer without disturbing the presentation. The base idea of the application can be used for simpler tasks too, like to create an electronic attendance register for lectures.

1   Introduction

David Willetts (ex-minister, UK) said that: 'area of old-fashioned university lectures - with students sitting in rows listening to academics - may be over as research shows large numbers of undergraduates now access professors' notes online universities will have to radically modernize lectures' (Telegraph *http://bit.ly/1ntkoDX*). Decades ago, there was no other way to learn novelties than to go to the university and listen to lectures or to go to the library to search for information. Today the situation is quite different. Besides schools and traditional libraries, there is a big information source the Internet, with a huge amount of always-available data. Meanwhile, students' learning methods and their expectations have also changed due to these modern possibilities. [Hay07] And what is more, they use several different kinds of electronic equipment in the same time. They are sitting in front of their computers, also close to their smartphones and usually the TV is turned on in the background. Therefore, they continuously receive a great variety of existing, colourful media-information flood. Thus, they are not accustomed to paying attention to only one thing like a traditional lecture any more. [Dan13] The situation is same as it is in a multi-process, multi-task environment. Now the student as the main processor schedules, which 'process' will be executed next? As in a normal environment usually it depends on the priority of the processes. We see, that in this race the 'priority' of the lecture is boosted lower than the priority of their mobile devices . Therefore, they are not able to follow and enjoy a traditional lecture anymore.

2   Bi-directional presentation management

We are engaged to activate students to take part in the lecture interactively, by using new techniques to bind their attention in a more effective way. [Ill15b] It is well known that there are existing voting systems available used by some universities for several years e.g. in University of Cambridge, but those are rather expensive ones. Moreover, using a voting system means only one-way interactivity initiated by the teacher. [HBa15] In a multi-threaded information world, a one-way information system is not enough, thus, people need new techniques to transform it (from the teacher to the students) into a bidirectional one.

It would be more effective if students were able to influence the explanations continuously sending their feedbacks or exact questions as electronic messages without disturbing the lecture needlessly. During the lecture, the professor (and no one else) can notice the messages and may decide to react immediately or to proceed the lecture undisturbed. Such possibility mixed with a voting system could give a new type of bi-directional presentation management tool to the lecturers. According to our hypothesis, this method increases the efficiency of university lectures. Therefore, the aim is clear, but how could it be achieved?

2.1   Not later, now, real-time

The first and the most important decision should be, what type of system would be the most appropriate for the given task?

Many information systems already work in real-time mode in our daily life as well like weather forecasts, traffic - or decision support systems etc. And what is more, nowadays, smart homes, smart cities, IoT (Internet of Things) are spreading quickly and they all use real-time connections, real-time data processing. [Ill15c] Therefore we do not have to be surprised at students' expectations that they want to learn information immediately, they are not accustomed to waiting too long for anything. Therefore a just in time response functionality is going to be an evidence for our management system.

It means nothing else than we have to think in developing some kind of real-time application. As we all now in the case of a real-time application we do have to finish the work within a given time. If overstepping the deadline with the response means some type of catastrophe (e.g. at a nuclear power station or in special medical systems) we are speaking about hard real-time which requires real-time OS (operating systems) too. Fortunately, in our case the response punctuality is not that seriously required, therefore we may choose tools from a wider set of possibilities. Nowadays an application development focuses generally into two directions. Let's create a web application which is easy accessed from every environment, or let's choose mobile one! We combine these ideas. A real-time mobile friendly web-application got into focus serving as a central management tool. In our Faculty (Faculty of Informatics, ELTE, Hungary) some facilities for implementing a web tool are already given like web-servers and free Wi-Fi system.

While we need an always-refreshing web page in client units as well, we have to think in a server push model (publish or subscribe model). Systems, which use the above-mentioned model, may be for example a synchronous conferencing application or the well-known mail-servers (using SMPT protocol) except the last step, which is

regularly based on a pull model. This model can be implemented in different ways e.g.:

- with continuous polling, using an always persistent HTTP connection, in which the server never closes the connection;

- with long polling, in which the server waits with the response till arriving data, and the client getting the answer sends a new request to the server immediately;

The next step is to choose some programming languages, developing environment for the work. There are several possibilities in this case as well, but ASP.NET seemed to be a good decision because of the complex and comfortable usage. Moreover, Microsoft ASP.Net supports SignalR library to implement a real-time server-push model. [Aqu14]. The sketch of SignalR mechanism is shown in Figure 1.
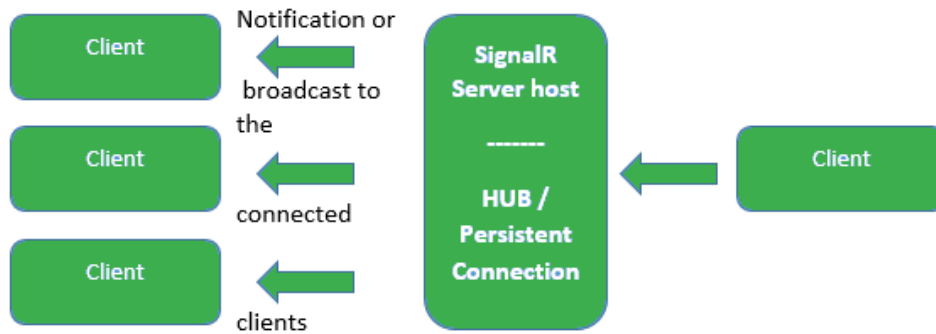

Figure 1: SignalR mechanism from http://www.codeguru.com

Further question is what can we use as client unit? It is almost impossible to transform auditoriums with built in units at each seats. It is also unimaginable to buy mobile equipment for this purpose, give them out, and get them back at the beginning and at the end of lectures.
However, anybody may observe that many students have smart phones, tablets or laptop, but the question is how many of them exactly have an adequate device.

2.2 BYOD (bring your own device)

Therefore, we prepared a survey in the academic year 2015-16, during the autumn semester, which measured among other things the rate of smart device penetration among students. The survey was made as a part of a bilateral Hungarian-Slovakian Project (TeT_12_Sk) [Ill15a].

Table 1: Personal mobile phones owned by students due to the survey

Types	Total	Hungarian	Slovakian
Smart phone	95,4%	92,4%	98,7%
Android	69,8%	68,4%	71,4%
Apple iPhone	3,3%	0,3%	6,2%
Windows Phone	5,2%	8,3%	2,3%
Other type	17,0%	15,3%	18,8%
Conventional phone	3,9%	6,3%	1,3%
No phone	0,7%	1,3%	0,0%

The above given results show that almost every student has a mobile phone and/or other mobile devices. More than about 95% of students have smart phones, but at about 23% of them do not have or do not use internet access. Among internet users, there are 63% having limitations in data amount.
The results have proven that the preconditions are ready for using students' personal mobile devices. Other leading universities also use students' personal devices in their teaching processes and what is more some of

Table 2: Internet usage due to the survey

Internet usage	Total	Hungarian	Slovakian
Does not use Internet	21,0%	23,1%	19,0%
Uses Internet	79,0%	76,9%	81,0%
3G/4G with limitation	63,7%	75,2%	53,2%
3G/4G without limitation	36,3%	24,8%	46,8%

Table 3: Data about other type of mobile devices owned by students

Total	Hungarian	Slovakian
65,7%	62,3%	69,3%

them specify the required equipment. That is called BYOD (bring your own device) concept which is spreading quickly [Cam].

There is one more viewpoint we have to notice. Our students (ELTE, Hungary) have different kind of devices mobile phones, tablets, laptops with several kinds of operating systems, display sizes, browser features. Therefore, we need to use a standard in order to create an adequate user interface. We have chosen the well-known, widespread solution for this: Bootstrap and the usage of JQuery for creating a mobile friendly client side.

A simple prototype system is already available at the time of writing this paper, but it stands before testing it under real circumstances. (*http://election.inf.elte.hu/*)

2.3 Election, the prototype of a bidirectional presentation management system

As it was discussed, our main aim is to modernize university lectures with the help of new management tools by using students' personal devices. The desired system should manage the lecturer's teaching process, helping him in making quick decisions, to observe students' problems in real-time and to map students' knowledge on the spot immediately. It should be the lecturer's decision to use the system anonymously or authorized. The advantage of the anonymous usage is to give a more comfortable feeling for students to put up questions freely without becoming ridiculous. The disadvantage is similar using anonymity; some of the students may use it to disturb the course with non-needed questions or impolite speech.

Measuring students' knowledge and opinion

Measuring students' basic knowledge of a given topic in an auditorium with several hundreds of students is not that easy task to perform quickly without wasting too much time. It practically means a voting system in which the lecturer may ask questions with given possible answers and students have to choose the proper one and send it back. In our prototype system the questions and the possible answers are stored in a database but the lecturer has the freedom to modify everything on the spot if it is needed for some reason.

The lecturer may see the statistic of the answers in real-time within a given time-interval which may help their decision to proceed or to stop to explain it once more.

The answers are logged for further investigations. It is planned, but it is not available yet, that students may download the questions and the proper answers to help their later preparations for the examinations. This way of usage - initiated from the lecturer - may be used at the end of the lesson to ask students about their opinions, what their interest index is.

Immediate signing or questioning

Conversation started by a student is more interesting because it is not that conventional solution. During a lecture, students may lose the thread in situations when the lecturer is not expecting it. Sometimes they do not want to interrupt the lecture thinking that everybody else understands it. In this moment, students may choose between two solutions:

- They may send a simple sign to the lecturer without disturbing others or the lecturer during explanation. The sign arrives to the lecturer's device and the application shows how many students have difficulties with the topic. In an authorized mode, the lecturer may specify the students' personality as well. Lecturers may follow who is active in questioning, who has difficulties and what kind of difficulties in order to be able to
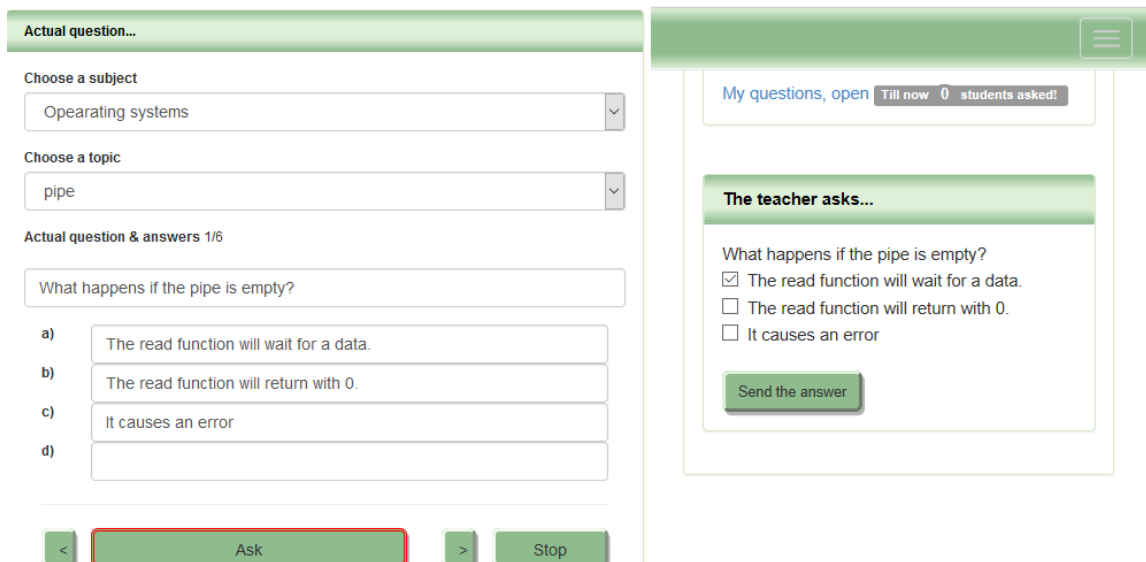
Figure 2: The Lecturer sends a question and students answer

help in a personalized way.

- Students may send exact questions as well if they can describe their problems. The professor sees the questions and determines the problem. He may decide whether to stop and answer the questions immediately or to postpone it Figure 3.
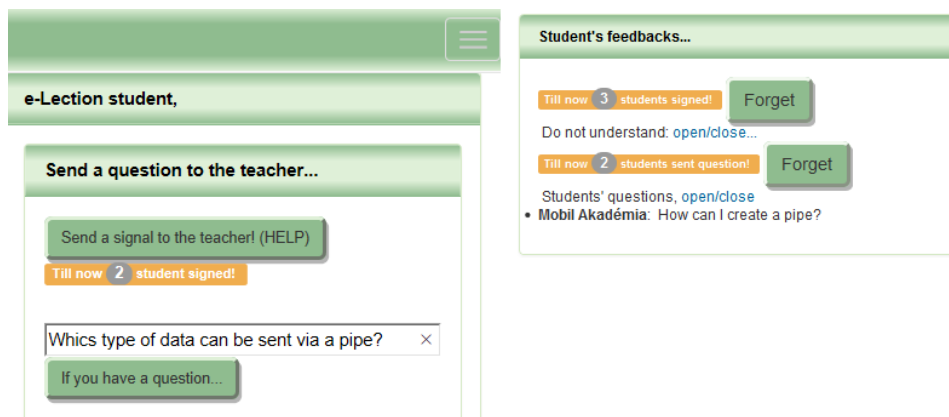

Figure 3: The student asks or signs, the lecturer receives it

2.4   Catalogue system

The whole process is logged; therefore, it can also be used as some kind of catalogue system, if it is needed. The Catalogue system is also ready for testing (*http://katalogus.inf.elte.hu*). Students use their standard university login names, passwords and receive an entry code from the lecturer, which is checked by the system as well. An IP checking is also built in to filter students' login outside the university area. The lecturer may start a login process and decides the length of its availability. Later they may see or download the registers and may manage them during the semester Figure 4. The student asks or signs, the lecturer receives it
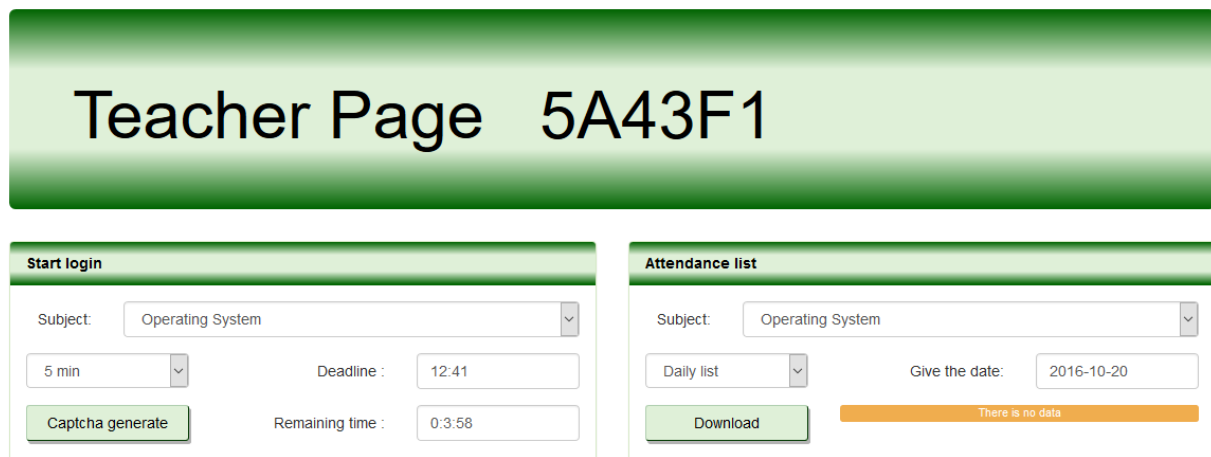
Figure 4: The Catalogue system, lecturer's view

3   Conclusion

The first decades of the 21st century according to increasing penetration of the mobile devices have caused a real revolution in education too, using new mobile technologies and relevant methods. According to the survey almost every student has an adequate smart device (notebook, smart phone, tablet) so we are ready to join to BYOD concepts. At the same time the always-connected smart devices boost the traditional lecture priority lower. This new suggestion, the bidirectional interactive presentation system, supported by eLection system is able to modernize, to make our lectures much more dynamic. The first test phase of our solution certifies our idea.

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