A Prototype of Effective Online Teaching Tools with Adaptive Navigation Support

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Abstract. This paper proposes a prototype of educational system based on adaptive navigation support to help teacher manage their courses online. In a university context, a teacher can have many courses in one semester. The courses consists of several topics with several material and assignments on it. In a such circumstances, a teacher must prepare the topic's material before they can go to the class. This situation can cause the teacher to overwhelmingly getting busy to identify which courses they want to focus on and which one they do not. Therefore, they need a tools as an aid to choose which courses they should focus on. In this study, a prototype has been built based on adaptive navigation approach to help teacher overcome the situation. Link hiding techniques were used as a mechanism to help user focus on one task at a time.

1. Introduction
The gradual emergence of e-learning adoption and research has raised the opportunity for enhancement in various dimensions [1]. There are two main parties involved in e-learning based activities, namely students and teacher. The innovation of e-learning system should covers both sides to increase the effectiveness of e-learning. For students, e-learning can expand their opportunities to learn various material [2]. For the teacher, e-learning provides them the ability to manage the courses being taught easier [3]. However, with the increase amount of courses and material that must be handled, the teacher can loose their control over courses. This in turn will affect the overall students’ performance. This paper proposes an approach on this domain by adopting adaptive navigation support in a form of system's prototype.

Adaptive navigation support is a technique for modifying the navigation pattern of system’s interface to match with the user’s objectives, preferences and knowledge [4]. It is a part adaptive system domain which is an intersection between hypermedia and user modeling techniques [5]. With such system, a teacher can ensure the availability of course material right on time its needed. Furthermore, they will received some notifications regarding to assignments’ due and student’s works. Thus, they can monitor the performance of the students in a more precise manner and compare it to the learning goals.

Mobile devices are currently becoming one of the primary means to access the internet [6]. It is because the spread of the devices worldwide. More and more people are using the devices to do various tasks. Education sector is progressively adopting the devices as a media of learning called mobile learning [7]. It changes the way of doing learning activities where material is delivered through the...
internet and accessed with mobile devices [8]. Considering this, the prototype will be designed based on mobile platform.

The rest of the paper is organized as follows. Section two describes an insight from previous works that denotes the existing finding about adaptive navigation support. Section three explain the methods in data gathering, systems’ architecture and design. Section four describes the system’s prototype including the user interface and adaptive features. Section five ends this paper with conclusion and discussion about possible future works.

2. Related Works
The adaptive system aims to accommodate user's characteristics in the system's interaction [5]. The adoption of adaptive system in educational context could be beneficial in several ways. With this kind of system, a students can have a personalized interface which specifically deliver the information about the course that only related to their capacity and the goals of learning [5]. It also provide the students the ability to increase their satisfaction on using adaptive system with which there is a possibility for them to improve their learning pace [4,9]. This paper adopt this advantage into teacher's context.

There are various adaptive systems were developed with different purposes and context. However, most of them were built to manage courses and the assignments. QuizGuide is built for students to be able to select the most relevant assignment for them with which they can assess their own knowledge and performance by themselves [10]. The system provide adaptive annotation shows the level of students' knowledge. Protus is an adaptive system which can be used to recommend the suitable course material to students to allows them get focus on particular information [11]. In ubiquitous learning, adaptive system was used as a means for providing suggestion on user's learning path [12]. In other research, the adaptive approach was used to match the system's interface with the user's learning styles which in turn will increase the learner's performance [13].

With the adaptive approach, the interface of the system was modified with some techniques in order to comply with user's characteristics so that the interaction's flow becomes easier. For the teacher, adaptive learning system is an innovative techniques for teaching. With this system, a teacher can ensure the availability of the course as they can monitor in time-based manner the material and assignment of the course.

Adaptive navigation support is a technique to manipulate the navigation model in the interface of the system. It flexibly change the structure of the links on a web-page to accommodate the user’s needs [4]. A research found that adaptive navigation support can makes the system’s navigation more efficient for user. It can suggest the user with the relevant path of task to navigate. Moreover, it can helps user decide what to do with the system [12]. In addition, with the adaptive navigation support, user will not make a repetition to a particular content. Contrarily, they can move quickly from one content to another. Thus, it opens a wider possibility for the user to find a new information [14].

3. Method
3.1. Data Collection
The data for this research was retrieved from the course of Web Programming taught for undergraduate students. The course consists of ten topics that will be taught one topic in a week. Table 1 depicts the topics of the course. Every topic comprises materials and quiz assignments. The materials can be in the form of presentation slides, video, audio, or PDFs. The quiz assignments due in one week after it was published by the teacher.

| Week | Topic                                      |
|------|--------------------------------------------|
| 1    | Introduction to Web Programming            |
3.2. The Design of System

The architecture of the system is depicted in Figure 1. The system comprises three primary elements, i.e. User Interface, Inference Engine, and Teacher's Model. The first elements arrange the layout of the system's user interface according to the current Teacher's Model. The teacher's model is actually a database that stores the information about courses, date of the topics, and material. Inference engine is a mechanism to keep the teacher's model updated based on the interaction between system and user.

It receive the information about the material and assignment that already prepared by the teacher and then update the teacher's model database. If there is a request to view the current task, it retrieve the current teacher's model from the database and select the most appropriate course to view based on the current date. In this study, the inference system will compile the information about unfinished courses. The unfinished course means that there are some works that need to be completed by the teacher, e.g. upload material, assess the assignments, answering questions.

![System’s Architecture](image)

**Figure 1. System’s Architecture**

The prototype has been built using Object Oriented Approach. Therefore, the functionality and the feature of the system is identified by the object. In this case, the design of the system is depicted in a usecase diagram that can be seen in Figure 2. The system allows teacher to add and view material and assignments based on teacher's model.
In this research, the adaptive method that has been used is adaptive link hiding, which will hide the unnecessary link. Link hiding is one of the technique in adaptive navigation support where the unnecessary link is hide from the user in order to reduce the complexity of interaction [4]. The objective is to help teacher focus on the task that must be completed first and omit the condition where the user pay no attention to the system. The following is the algorithm in adaptive link hiding.

```
begin
    identify current date;
    if (current_date = topic_date) {
        view current_topic;
    }
    identify previous task;
    if (quiz <> 100) {
        task = unfinished;
        view unfinished tasks from previous topics;
    }
end
```

**Figure 2. Primary Features of System in Usecase Diagram**

4. Results

As the application built for mobile devices, its interface was designed by following the mobile user interface design guideline from [15]. According to the guideline, all the screen elements should be arranged in vertical stack. In this study, material and assignments are grouped into one block that represents a topic. Each block is stacked vertically. The layout of homepage of the system, by follow the guideline, can be seen in Figure 4.
Figure 4. Homepage

Figure 5. Main interface of the course

Figure 6. Adaptive Interface showing unfinished course

Figure 7. Adaptive Interface with Simple Graphical representation

Figure 4 shows the landing page of the system. It shows all the courses being taught by the teacher. The main feature of the system is the arrangement of its interface where the system only exhibits the material that is relevant to the teacher. In this context, the system will match the scheduled material to the current date. Figure 5 shows the screen displaying the initial topic of the semester. On this screen, there are only one material and assignment related to topic 1. The rest of the topics are hidden automatically by the system and the user will not see it.

With this kind of treatment, a teacher can concentrate only on related topics in terms of preparing the material and assignments. They can add material, which comprises several types of files such as PDF, documents, spreadsheet, audio, and video. In addition, they can also add assignments related to the topic. Furthermore, a teacher can also monitor the progress of each topic.

When it comes to the second week, the interface will show topic 2 as a main task for the teacher to prepare the course material and assignments. In addition, the unfinished assignment from previous topics will appear at the bottom of the screen. This will allow the teacher to keep informed regarding its progress. The scenario is depicted in Figure 6. The process is iterating each time the course is progressed into the next topic.

To accommodate the flexibility factor, the system provides a switch button to shift between normal and adaptive modes. When in normal mode, the teacher will be able to see all the topics on one screen.
Otherwise, when in adaptive mode, the adaptive (hiding) algorithm will be deployed to select the most appropriate topic and display it on the screen. With this kind of feature, a teacher can either view all courses in an overall look or in more focused way.

The adaptive ability of the system is depicted in Figure 7. The interface lists all topic with corresponding annotation whether it is finished, unfinished or disable.

5. Conclusions
This study proposes a prototype of a system that can help teacher manage their courses better with Adaptive Navigation Support approach. The system consists of three components, namely user interface, inference engine, and teacher's model. It will automatically arrange the user interface and select the appropriate material only. With this kind of system, a teacher will be able to organize their courses better and faster. It also increase the effectiveness of learning activities.

This study presents the prototype of application. Future works could be done to implement the system in real educational settings and evaluate the result. Moreover, evaluating the impact of the system amid the teacher would also be an interesting research topic.

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