Synchronization of Lecture Slides and Video

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ABSRACT

The proposed deployment of the video lecture recording initiative at the University of Cape Town (UCT) may not be comprehensive enough, as it will only record the lecturer without the slides. The result is a system that the users do not want. A lecture slide synchronization program was created and tested. The report concludes that such software is appreciated by users.

Categories and Subject Descriptors

H.5.1 **[Information Interfaces and Presentation]:** Multimedia Information Systems – *Artificial, augmented and virtual realities.*

General Terms

Experimentation, Human Factors

Keywords

Lectures slide and video synchronization, synchronized podcasts

1 INTRODUCTION

The proposed deployment of the video lecture recording initiative at the University of Cape Town (UCT) may not be comprehensive enough, as it will only record the lecturer without the slides. Most students would arguably prefer lecture and slides synchronized perfectly, potentially creating a virtual lecture environment. If UCT deploys a system that does not satisfy users demand, it will be unusable.

Video podcasting is the recording of videos that can be used later for public distribution.
In South Africa, the University of KwaZulu-Natal was the first to use video podcasting as an aid for teaching [9]. This initiative allows students to view lectures in the form of audio or video formats but not synchronize the lecture slides with video. Some universities that have achieved this desired synchronization include: Stanford University [8], City University of Honk Kong & Technology [2] and Michigan State University [5]. Microsoft Producer for PowerPoint [6] is a free Microsoft PowerPoint add-on that allows users to synchronize the lecture slides with video but lacks versatility as it only works with few web browsers. For this reason, the research conducted had to create an original synchronization software to achieve this tasks with more versatility.

There seems to be a booming market for synchronization software, as most products that do what the project achieved and a little more, costs hundreds of dollars. For example: Camtasia Studio [7] costs $300 per copy for providing this service and other advance features like speech to text caption. Indeed, the benefit of developing home-grown software is that

deployment, maintenance, extendibility (and much more) is simplified dramatically.
The aim of this research/project was to develop software that was user friendly and provided a seamless experience (simulates a real lecture).

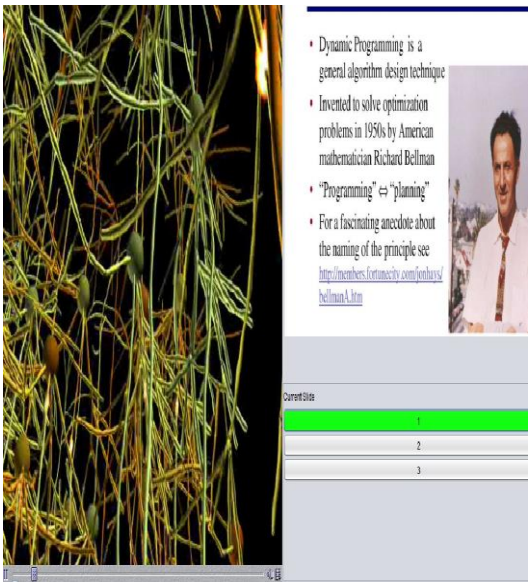

Figure 1: General Shot of Software

2 PROCESS

2.1 Methodology

The overall procedure involves development (recording and editing), testing and production. The recording phase requires the use of a single camera to record the lecturer. During editing, the synchronization (sync) software merges the slides with the video, with each slide being displayed for an even interval. The final video is a split screen of the lecturer in one panel and the slides in the other. A bookmark is placed at each slide enabling users to move to any slide, with the video changed simultaneously.

2.2 Software Developing

2.2.1 Displaying Slideshow

In order to simplify some preliminary tasks and for the sake of modularity, some free image converters were used. These were: CutePDF Writer [3] which converts the Microsoft PowerPoint slides into PDF and Boxoft PDF to JPEG converter [1] (to make each lecture slide a JPEG image). This makes the application faster as JPEGs is a very compressed image format.

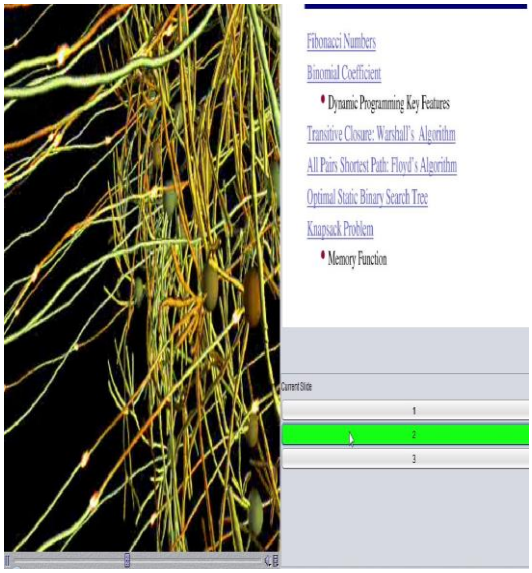

Figure 2: Selecting a slide

2.2.2 Displaying Video

It did not take long to discover the Java Media Framework Player [4] is the industry standard media player and a convenient tool to have. It saved the development of a media player and its API allowed for adapting its functionality to the project.

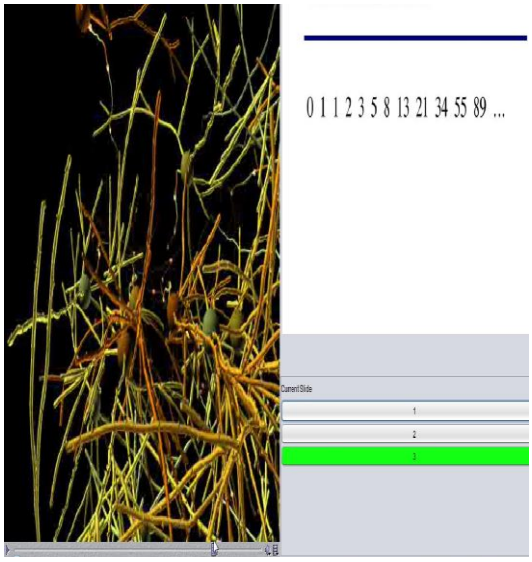

Figure 3: Moving the video slider

2.2.3 Synchronization

The synchronization that was intended to be achieved was to have the user be able to move the video position whilst having the lecture slides keep pace and vice versa. A bookmark/icon was generated for each lecture slide, to allow the user to select a lecture slide and have the video change correspondingly.
To simplify matters, the assumption made is that lecture slides evenly divide the video and that the lecturer speaks about the slides in sequence – meaning the slides are displayed in sequential order.

The key to achieving synchronization was to calculate mathematically what where the ideal timings for synchronization and then draw out all the timing expectations of the video and slides on paper. The sync mostly used event-driven programming, as a timer was used to change the slides every few seconds (sequentially) but needed to be stopped and restarted upon certain requests.
If a slide bookmark was clicked, the timer would stop, that slide would be display and the corresponding video portion would be displayed and the timer then gets restarted. Depending on the speed of a computer, there can be almost no visible delay in the sync mechanism.

2.3 Evaluation

Once the software was completed, 3 tertiary students participated in a user test.
The evaluation consisted of the users inserting the inputs for the program, which are: any lecture slide jpeg file and video, and experimenting with the synchronized video produced.
The users would experiment by moving the video at various places whilst checking if the lecture slides switched instantly and vice versa. All had at least Celeron/Pentium Dual Processors and 2GB of RAM. The questions asked were partitioned as follows:

Factor Tested	**Question/s**
User friendliness	Q1 and Q2
Seamless User Experience	Q3 and Q4
Future Questions	Q5

The questions are listed below:

1. Is the interface simple and easy to use?

   (Rate low or medium or high)
2. Do the slide bookmarks help in navigation?
   (Yes or No)

3. Was the synchronization rate between video and slides good?

   (Rate low or medium or high)
4. Overall impression of the system?

   (Rate low or medium or high)
5. What can be improved in future?

3 RESULTS

Figure 4 shows the results of the survey:

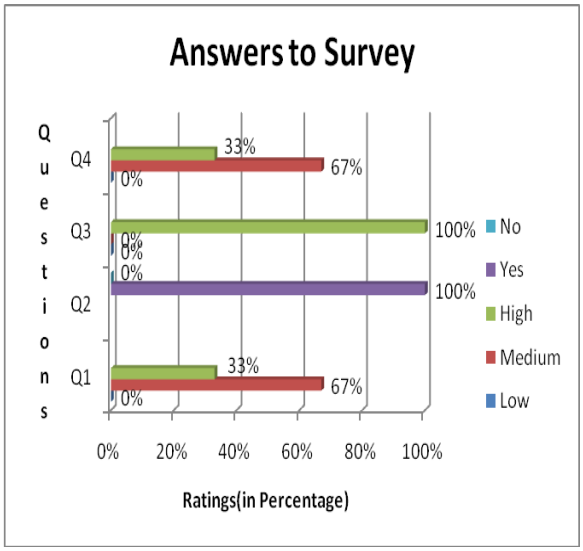

Figure 4: The Survey Results

Question 5, requested for the user to express any further suggestions for improvement of the synchronization software. These were the responses:

- More beautiful graphic interface
- To have a detection algorithm to change the slides in the software exactly when the lecturer changes them.
- To be able to write questions on the video and automatically forward them to a FAQ section for the course.

4 DISCUSSION

The results from the first 2 questions show that the software is highly user friendly and enjoyable to users (67% Medium in Q1 and 100% in Q2). The results from the next 2 questions (100% High in Q3 and 67% Medium in Q4) show that the software is seamless (simulating a real lecture-like experience). The last question revealed some new insights on the software:

Future suggestions include a slide detection algorithm based on lecturer's voice, so the slides will always match what the lecturer says. It was also reported that the graphics user interface (GUI) could be improved to look more appealing and this can be catered for in the future by using improved design principles. It was also felt that a user should be able to write questions on the video and automatically forward them to a FAQ section for the course relating to the lecture. Of these suggestions, the GUI improvement is the most feasible although the others are valid; they are more long term recommendations.

It is true that this survey was in no way holistic however it was courteous to the users' limited time and provided an overall impression of the software. If the experiment was carried out in a longer time, this might have affected user's feedback as they might detect finer details present or missing in the software. Another factor that affects the results is computing power. Although, the computers used were of similar specifications, the synchronization rate was almost instant on a certain machine due to its speed.

The importance of these results is that synchronized podcasts is actually wanted by students hence deploying it should actually work out.

5 CONCLUSION

The research has shown (although on a small sample) that synchronized podcasts is something that students enjoy and provides a seamless user experience. Future work would involve testing on a more extensive sample of students and also to have lecture slides that correspond exactly to what the lecturer is saying.

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