Synote Discussion

Extending Synote to support threaded discussions synchronised with recorded videos

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Abstract—**Synote Discussion has been developed as an accessible cross device and cross browser HTML5 web-based collaborative replay, annotation and discussion extension of the award winning open source Synote which has since 2008 made web-based recordings easier to access, search, manage, and exploit for learners, teachers and others. While Synote enables users to create comments in 'Synmarks' synchronized with any point in a recording it does not support users to comment on these Synmarks in a discussion thread. Synote Discussion supports commenting on Synmarks stored as discussions in its own database and published as Linked data so they are available for Synote or other systems to use. This paper explains the requirements and design of Synote Discussion, presents the results of a usability study and summarises conclusions and future planned work.**

Keywords- video; synchronise; comment; discussion

I. INTRODUCTION

Synote [1] overcomes the problem that while users can easily bookmark, search, link to, or tag the WHOLE of a recording available on the web they cannot easily find, or associate their notes or resources with, PART of that recording [2]. As an analogy, users would clearly find a textbook difficult to use if it had no contents page, index or page numbers. Synote can use speech recognition to synchronise audio or video recordings of lectures or pre-recorded teaching material with a transcript, slides and images and student or teacher created notes. Synote won the 2009 EUNIS International E-learning Award [3] [4] and 2011 Times Higher Education Outstanding ICT Initiative of the Year award [5]. The system is unique as it is free to use, automatically or manually creates and synchronises transcriptions, allows teachers and students to create real time synchronised notes or tags and facilitates the capture and replay of recordings stored anywhere on the web in a wide range of media formats and browsers. Synote has been developed and evaluated with the involvement of users and with the support of JISC [6] and Net4Voice [7]. Figure 1 shows the Synote player interface. The technical aspects of the system, including the Grails Framework and the Hypermedia Model used, have been explained in detail elsewhere [8]. The synchronised bookmarks, containing notes, tags and links are called Synmarks (Figure 2). When the recording is replayed the currently spoken words are

shown highlighted in the transcript. Selecting a Synmark, transcript word or Slide/Image moves the recording to the corresponding synchronised time. The provision of text captions and images synchronized with audio and video enables all their communication qualities and strengths to be available as appropriate for different contexts, content, tasks, learning styles, learning preferences and learning differences. Text can reduce the memory demands of spoken language; speech can better express subtle emotions; while images can communicate moods, relationships and complex information holistically. Synote's synchronised transcripts enable the recordings to be searched while also helping support non-native speakers (e.g., international students) and deaf and hearing impaired students understand the spoken text. The use of text descriptions and annotations of video or images help blind or visually impaired students understand the visually presented information. So that students do not need to retype handwritten notes they had taken in class into Synote after the recording, notes taken live in class on mobile phones or laptops using Twitter [9][10] can
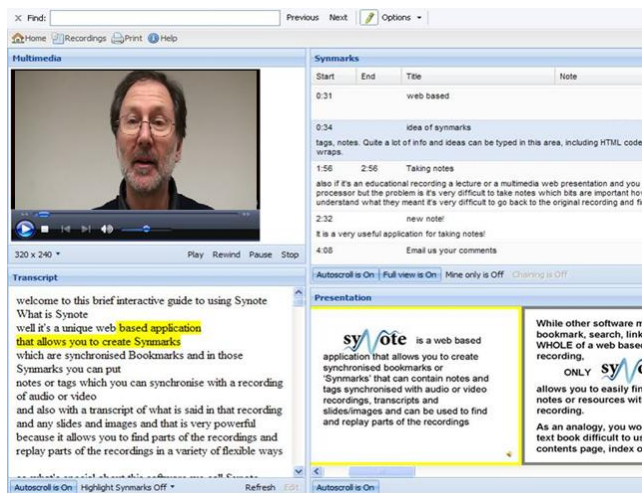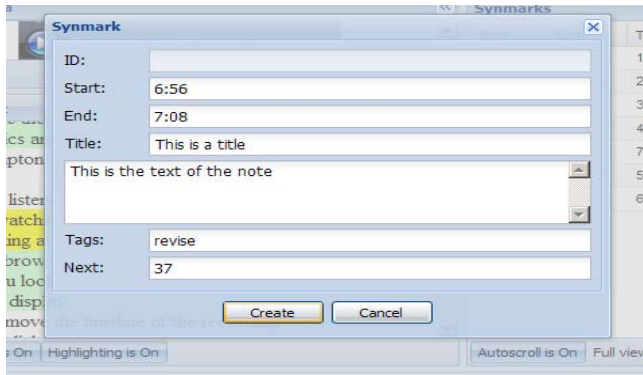

Figure 1.   Synote Player Interface

Figure 2.   Synote Synmark Creation

be automatically uploaded into Synote. Synote builds on 12 years work on the use of speech recognition for learning in collaboration with IBM, and the international Liberated Learning Consortium [11] [12]. The integration of the speaker independent IBM Hosted Transcription System with Synote has simplified the process of transcription giving word error rates of between 15% - 30% for UK speakers using headset microphones. This compares well with the National Institutes of Standards (NIST) Speech Group reported WER of 28% for individual head mounted microphones in lectures [13].

While most UK students now carry mobile devices capable of replaying Internet video, the majority of these devices cannot replay Synote's accessible, searchable, annotated recordings as Synote was created in 2008 when few students had phones or tablets capable of replaying these videos. Synote Mobile [14] (Figure 3) was therefore developed as an HTML5 responsive design web application capable of working in the majority of browsers on mobile devices running an Android, Windows, Apple iOS system

Figure 3.   Comparing Galaxy and iPad presentation of Synote Mobile

that can use YouTube's captioning and transcription service to allow for timed stamped data to be annotated and shared with others [15]. The fall forward approach of MediaElement.js [16] means that should the HTML5 player fail on the device Synote Mobile will present the user with Silverlight or Flash and vice versa in a fall back situation. This solution appears to work with most browsers despite the lack of player access alongside the transcription on smaller mobile devices. It allows for accessibility with captions and transcriptions and provides the user with a way of interacting with others whilst working with video and audio files. This allows for video captured lectures to be not only more accessible to those who have hearing impairments but also allows all students to go back over content in a way that may suit their learning preferences whether they are in the university, at home or when travelling.

Video sharing sites such as YouTube (RX) allow users to discuss the whole video using comments but these discussions cannot be linked to a particular part of the video

Neither Synote nor Synote mobile support threaded discussions as their Synmarks are annotations of the recording timeline. Synote discussion was therefore developed to enable students to have a discussion about a topic raised in the recording in such a way that the discussion is linked to the particular part of the recording being discussed. Section II explains the requirements and design, Section III presents the usability test results while Section IV summarises the conclusions and future work.

II.   SYNOTE DISCUSSION REQUIREMENTS & DESIGN

In order to be able to rapidly prototype a system to experiment with the best way of achieving the aims it was decided that rather than redesign Synote's database to allow for this new form of discussion annotation a new database would be created to hold these discussions and the users' threads and comments. In order to ease the integration of Synote Discussion with the original Synote, the comments are further published as linked data using Resource Description Framework (RDF) [17] Key requirements included:

- view Synote presentations as slides or image snapshots of video and an associated transcript with a link to the video on Synote.
- view a list of Synmarks relating to a particular time of the presentation and a list of comments for each Synmark
- add Synmarks and add, edit or delete comments to Synmarks.
- notifications on comments being posted on Synmarks and navigate directly to those Synmarks
- export the discussions as linked data so that it could be accessed and reused by other applications, especially the original Synote
- support the main mobile devices, web browsers and screen sizes in both portrait and landscape modes.

The application was designed to be consistent so none of the features become hidden or removed on different screen sized devices with each page having the same base design and a similar layout for content. Much of the content displayed is interactive with components designed to look 'selectable' and interactive to makes it easier for the user to intuitively navigate the website.
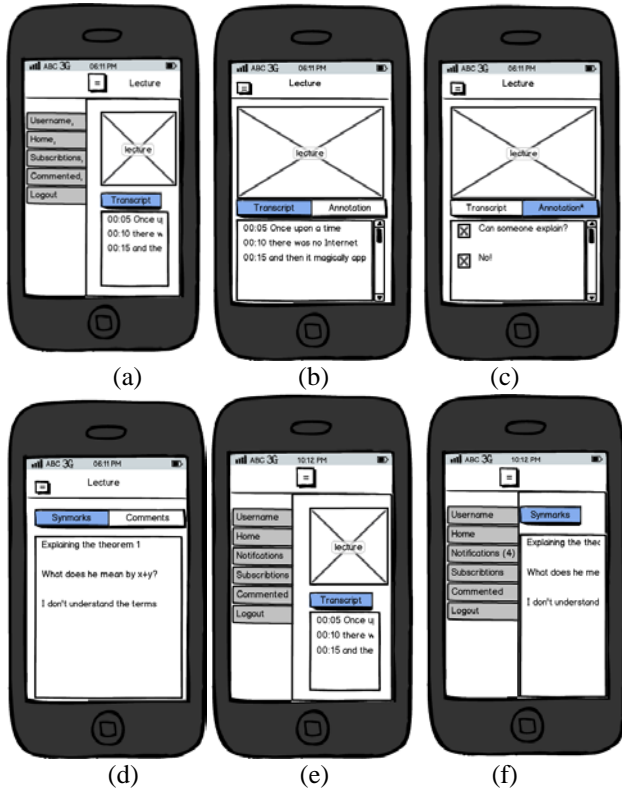

Figure 4.   Wireframe sketches of the design.

Figure 4 shows sketches of the designs and this section provides explanations behind the design decisions. Figure 4a shows the menu of the system, which is hidden until the user clicks on the menu button (located in the top left corner of the screen). When the button is selected, the main screen is shifted to the right and the menu bar is shown. This design has been inspired by a number of extremely popular web applications used by the target audience of students, including Facebook Mobile [18], which has a similar sliding menu feature. These menu indicators have become a mobile standard, with this design approach being featured in most major utility mobile applications, not just Facebook.

Figure 4b demonstrates the design of the main detailed view of a presentation in the application. This shows the transcript - a feature taken from Synote - in the bottom half of the screen. As the presentation's slides are being changed, the transcript is kept synchronised with the displayed slide so it is easier for users to follow the lecture.

Figure 4c also shows the main detailed view of a presentation, however, this time in the 'Annotations' tab. This tab holds the Synmarks and Discussions (the top layer

of threads). Like the transcript, the Synmarks are synchronised for every time frame (slide) of the lecture. The Synmark's appearance has been made visibly obvious to show that a Synmark is 'clickable' for the user to be redirected to the comments page for that Synmark (not shown in any of the wireframe figures). The page is where a user can view a list of their own Synmarks that they have started in the first tab, and their own comments in the other tab. Every Synmark and Comment in the list is 'selectable,' and directs the user to the presentation page that the content is related to and the Synmark within that presentation.

A very similar design is used for Subscriptions and the users Notifications pages (Fig, 4d & 4e) If the user has any notifications, these are highlighted to the user in the sliding menu, with the number of notifications is in brackets in the menu.

A. Discussions

In the system, users can make two levels of annotations to a presentation, similar to the way an online forum works. At the top level are"discussions", which are associated with part of a presentation. These are considered to be equivalent to Synmarks, which are comments on the presentation made in Synote. In order for the discussion to relate to a certain presentation, it stores a presentation ID. However, a discussion should only relate to a certain section of the presentation, so that it can be displayed when the user is viewing that part of the presentation. In order to allow this, a start time and optional end time are stored with the discussion. Since each presentation is split up into a number of sections with their own IDs, this could have been implemented by storing the section ID rather than the presentation ID. However, by implementing it with a start and end time, this allows a discussion to relate to multiple sections, thereby implementing a many-to-many relationship between sections and discussions without having to represent this in the database. Discussions also store an author ID and a timestamp, so that the application can determine when the discussion was created for ordering purposes and who created it.

B. Comments

Comments are the second level of annotations, and can be posted in relation to either existing discussions or Synmarks. Since these two types of comments have to store different IDs, the database allows for this by implementing these two types as two different objects, which inherit from a generic Comment object. Therefore, three tables are required: a table for Synmark comments, which stores a generic comment ID and a synmark ID, a table for Discussion comments, which is the same but stores a discussion ID, and finally a generic comment table, which stores the content of the comment, author and various other data about the comment. Rather than allowing users to actually delete comments completely, a deleted field is included instead, which allows a comment to be marked as deleted. This is so that a placeholder can be put in place of the comment so that users can see it is deleted.

C. Subscriptions

Users can subscribe to presentations, Synmarks and discussions to receive notifications when other users comment. Since subscriptions are allowed on all these different entities, a similar inheritance structure to that described for comments is required to make this possible. Even though the general subscription entity only contains a user ID and a primary key, it was decided that the inheritance was still necessary in case it became apparent that more fields were required in the general entity.

D. Notifications

Users need to be notified when either a discussion is posted to a presentation they are subscribed to or a comment is posted to a discussion/Synmark they are subscribed to. Therefore, there are different notifications related to discussions and to comments; this means that inheritance is used once again. The user navigates across the website using a sidebar (Figure 5) that appears on the left of the screen when a button is clicked. The sidebar also displays an indicator showing the number of notifications a user currently has. By only appearing when the user wants to navigate to a new page, this allows the front end to fully utilise the limited space available on a mobile device. The sidebar has its own template which is included in the other templates, allowing it to be changed easily and ensuring it remains consistent across the website.

E. Navigation and Display

The front end uses a mobile-optimised navigation system where, when the user tries to navigate to a new page, the front end fetches the information from the back end and creates it in a page hidden from the user, which then slides into view upon completion, replacing the original page. A loading animation is presented to the user while the page is loaded (Figure 6), and notifies the user if an error has occurred that has prevented the new page from being loaded correctly.
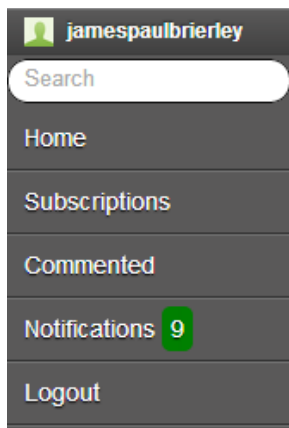

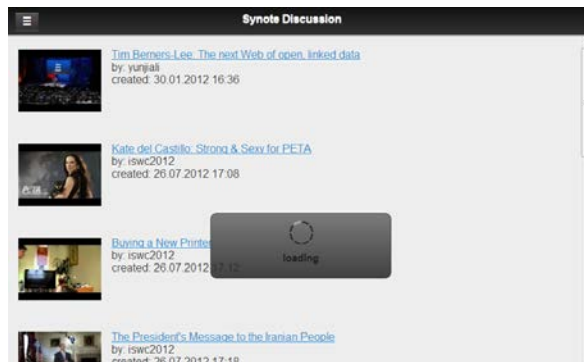Figure 5.   Screenshot of the menu sidebar bar..

Figure 6.   Screenshot showing loading the new page, the menu button can be seen in the top left of the menu sidebar bar.
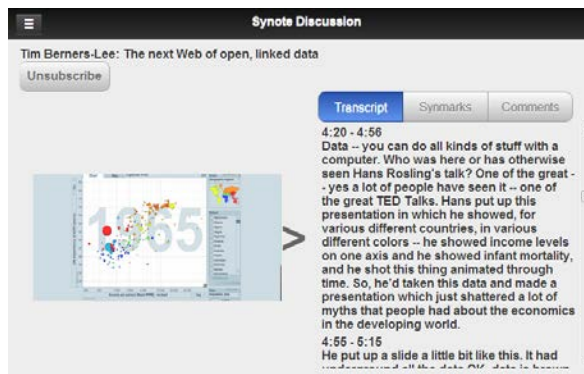

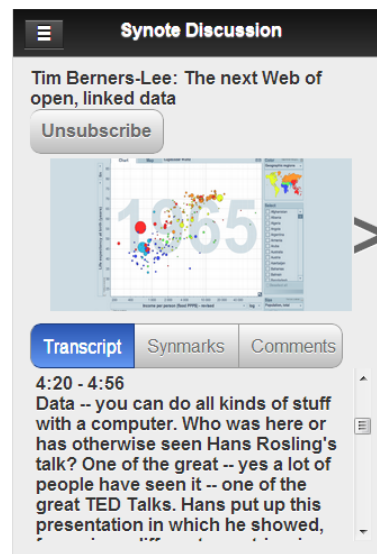Figure 7.   Screenshots showing the presentations displayed in landscape mode.

Figure 8.   Sketches Screenshots showing the presentations displayed in portrait mode.

The main page of the website, the details page, which displays the presentation has two different display modes, one designed for a landscape aspect ratio (Figure 7) and one

designed for a portrait aspect ratio (Figure 8). This is to allow the website to be displayed in an optimal fashion when a user rotates their mobile device. The presentations are designed to be displayed in as responsive a way as possible. Switching between slides will automatically scroll the transcript to the appropriate section for that slide, and selecting a Synmark will automatically scroll to the image that applies to that Synmark. Users can subscribe to presentations and Synmarks, allowing them to receive notifications when a new Synmark or comment is added. There is also a subscriptions page, where the user can see a list of all their current subscriptions, and remove or navigate to each individual subscription. There is a page where users can view a list of Synmarks and comments that they themselves have added and there is a page where users can view all their notifications, with options to remove individual notifications or clear all notifications.

III. USABILITY TESTS

Usability testing involved 10 university students, the target group for the system, participating remotely. The participants were asked to test the application on any mobile, tablet or desktop web browser of their choosing. They were given directions as to where the application was located and were asked to use it freely for as long as they needed to get acquainted with it. Following this, they were each asked to perform a range of specified actions/tasks. After completing the tasks, they were each asked several questions about their experiences and were asked to give some feedback about the application.

Tasks they were asked to perform were: 1. Login; 2. Explore the home page and navigate to a presentation; 3. Navigate through the presentation and leave a comment on one of the slides; 4. Create their own discussion; 5. Subscribe to that presentation; 6. Subscribe to one of the discussions and leave a comment there; 7. Someone has left a comment on their discussion, how would they quickly find out about it?; 8. From the subscriptions page, quickly navigate to one of the discussions they are subscribed to and unsubscribe from it; 9. Navigate to one of the discussions they have left a comment on; 10. Try to edit and delete some of their comments

IV. USABILITY TEST RESULTS

Most of the users said that initially they were not sure what the purpose of the application was. After they logged in and browsed around, it was slightly clearer that the application was a media store, although it was not clear what types of the media were stored (e.g., whether it was YouTube entertainment videos, or educational recordings from lectures). This may have been due to some of the test content used on Synote being unrelated to educational material. Some of the participants also expressed their hesitation with using their external authentication details, even though they had been explained how to revoke the access from the application to their details later on. All the participants said that it would have been more convenient for

them to at least to have an option of being able to register with the system separately and hence not to give away their external details. Some participants found it was irritating that on some of their devices they encountered loading errors and the only fix offered was reloading the application. Although it did not cause any major test disturbance, it was concluded that this issue could put off the potential users from using the application. Most of the participants did not understand (until they were told) what the Synmarks were and why they could not add comments to a presentation without selecting a Synmark related to a slide. It was concluded that because most of the participants were not familiar with the original Synote system and terminology, they could not have been expected to understand this initially. The participants also expressed a slight confusion with the fact that the Synmarks were moving the presentation slides, although all of the participants agreed that synchronizing transcript and Synmarks according to the time frame of the related slide was one of the most useful features. However, according to the users the confusing comments tab when no Synmark is selected, should not appear. All of the participants agreed that because of the lack of distracting information, it was easier to perform the tasks and the application was very straightforward and intuitive to use. All of them also concluded that because the application has a very typical mobile platform look, it was very easy to learn how to navigate around whilst performing the tasks. It was agreed that none of the features were hidden from the view or were awkward to uncover in order to complete the test. One of the participants did, however, find it slightly irritating to keep checking the (hidden) menu bar for the notifications. It was suggested that the notifications should constantly be visible to a user, no matter whether the sliding menu was in its hidden or visible state. All of the participants gave positive feedback on the design layout and overall design consistency. It was agreed that the layout of the items and colours was generally reasonable and intuitive. It was admitted, however, that because the application was designed to be mainly served as a mobile application, its layout and components are more pleasant to the eye on tablets and mobiles rather than desktop browsers. The application also received positive feedback on how visually"adaptable" it was as the screen size and platform the participant used did not have an effect. Most of the participants also agreed on the usefulness of such an application and its features in their studies, although some of them said that the unfamiliarity with the original Synote would put them off. Almost all of the participants agreed that there would not be any situations when the application would be hard or impossible to use. Only one participant suggested a weak point was the requirement to have a constant Internet connection in order to access and manipulate the data. There could be potential issues with the connection availability due to the content being available only online. All of the test participants concluded that the reason they had some difficulties with understanding what the system was for and what they were to do to complete the set tasks, was that there were no help messages provided for their learning. Participants also suggested there should be different user

groups for the resource owners and so separate the lecturers/uploaders from the student resource users. In particular that feature would be useful during the discussions as it would be easier to distinguish lecturers from the students.

Overall the users had a positive experience with the system, referring to it as friendly, straightforward and, best of all, compatible with several platforms. The feedback proved useful and influenced the development of the system.

V. CONCLUSION AND FUTURE WORK

Synote Discussion has been developed as an accessible cross device and cross browser HTML5 web-based collaborative replay, annotation and discussion extension of the award winning open source Synote which has since 2008 made web-based recordings easier to access, search, manage, and exploit for learners, teachers and others. While Synote enables users to create comments in 'Synmarks' synchronized with any point in a recording it does not support users to comment on these Synmarks in a discussion thread as Synmarks are annotations of the recording timeline. Synote discussion was therefore developed to enable students to have a discussion about a topic raised in the recording in such a way that the discussion is linked to the particular part of the recording being discussed.

Synote Discussion supports commenting on Synmarks stored as discussions in its own database and published as Linked data so they are available for Synote or other systems to use. Synote Discussion provides an extension to Synote with discussion commenting and Facebook style notifications that work effectively on iOS and Android mobile operating systems and common mobile web browsers. The key requirements were met to enable Synote's data to be displayed and augmented with discussions and comments while Synote Discussion's stored discussion threads and comments can be accessed as open linked data.

The usability tests showed that once users understood the purpose of the application, they found all of the features easily to use but accessing Synote Discussion through a link from Synote would make the relationship between the two applications clearer.

It is planned to introduce this link from Synote and undertake further trials of Synote discussion in real classes with a larger number of users and including a wider range of mobile, tablet or desktop web browsers.

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