

NoteTaker – A web application for note-taking

Kai Liu

Georgia Institute of Technology

Atlanta, GA

kliu99@gatech.edu

ABSTRACT

This paper presented a note-taking web application for online learners – NOTETAKER (<https://github.gatech.edu/pages/kliu99/Note-Taker>). The application aims to allow synchronized video watching and note-taking as well as easy sharing options. The application is developed using REACT and many other JavaScript libraries. A chrome extension allows the user to open the NOTETAKER and start taking notes effortlessly. The main note-taking interface has integrated video watching and note-taking. The library interface gives a list of notes the user already taken on the machine to allow notes management and review. The share interface aims to give a comprehensive view of all the notes that are taken for a particular video and allows the user to export notes as JSON, Word or PDF file.

Author Keywords

Note-taking; online learning; web application; synchronized; integrated

INTRODUCTION

According to the literature, note-taking is one of effective learning strategies. For example, Jansen et al. state that students frequently engage in note-taking to improve the amount of information they remember from lectures [6]. Einstein et al. investigated the encoding function of note-taking and processing differences between successful and less successful students in lecture situations [4]. Results suggest that note-taking enhanced organizational processing of lecture information. Peper et al. conducted three experiments investigating the effects of note-taking on "what is learned" by college undergraduates from videotaped lectures [16]. The results suggest that note-taking can result in a broader learning outcome, rather than just more learning overall, because an assimilative encoding process is encouraged [16]. However, simply copy and paste the texts from the text book can be detrimental to learning [2]. Katayama et al. also studied the differences between (a) copying and pasting text versus typed note-taking methods of constructing study notes simultaneously with (b) vertically scaffolded versus horizontally scaffold notes on knowledge

transfer [7]. Forty-seven students participated their research, and they conclude that keying in notes leads to higher retention of knowledge transfer than copying and pasting notes after a 1-week delay [7].

With the advance of modern technologies, note-taking is no longer limited to just using paper and pen, researchers start to study the effectiveness on e-note-taking. Mueller et al. performed three studies in their research, they found that students who took notes on laptops performed worse on conceptual questions than students who took notes longhand [14]. Kauffman et al. conducted study on the effects of online note-taking formats and self-monitoring prompts. Results of both experiments indicated that the matrix note-taking device was a superior tool for collecting information and for achievement [8]. In the interviews conducted by Veletsianos et al., they found that even though none of the popular MOOC platforms support integrated note-taking at the time of writing this paper, nearly all interviewees reported taking notes while watching lecture videos [21]. Also, they found that sharing notes and information with others was mentioned by several learners. Notably, "sharing with others" was described just as frequently as using notes to support studying, taking quizzes or doing writing assignments. Learners also planned to use their notes for personal and professional purposes after courses were over. Clearly, there is a gap on the online learning platform and note-taking, an integrated tool is needed, and, it is important to being able to share the notes with others.

EXISTING TOOLS

There are many tools that can take screenshots and taking notes. We have categorized such tools into three categories, namely, tools that can take screenshot and markup, tools that can take and organize notes, and tools that design for MOOC. The popular tools in each category is listed in the following.

Tools that can take screenshot and markup:

- Snipping tool on Windows
- Screenshot tool + Preview on MacOS
- LIGHTSHOT [12]
- GREENSHOT [20]
- SNAGIT [19]

The tools mentioned above are not design for note-taking purpose. To take notes with the above tool, one need to combine it

with other tools, such as Microsoft Word. The general process of using the screenshot tools to take notes involving:

1. Pause the video
2. Take a screen shot
3. Copy to Word document
4. Markup the screen shot, e.g., highlight lines on the screenshot, circle some contents
5. Write notes about the screenshot (slide), sometimes also include timestamp.

The advantage of using Word + Screenshot tool is that it is easy to share with others, you can print the document, send by email, etc. However, it is a tedious, repeated process. To ease such process, some tools are developed, and are specifically designed to take and organize notes on the computer. Such tools including, but not limited to:

- EVERNOTE [5]
- MICROSOFT ONENOTE [15]
- GOOGLE KEEP [9]

Sharing the notes taken by such tools can be as easy as sending a link. However, it does require the recipient have an account/license for the service provider. Such tools reduce the effort to taking notes on a computer, however, it still requires to switch between online learning platform and note-taking software. It is not an integrated process. Some tools are developed to integrate the note-taking process, such as:

- VIDEONOTES [22]
- MOOCNOTE [13]

In such interface, the video watching and note-taking are in one page. No switching between software/interfaces is required. Sharing is supported in such tool. However, it still requires an account for the service in order to view/edit the note. Another disadvantage is that such online tools do not allow offline viewing of the notes.

Therefore, to improve the existing tools, we have proposed the following functionalities to the note-taking application including:

- Synchronized video watching and note-taking (on the same page)
- Easy sharing options

DESIGN GOALS

This section discusses the two identified design goals in details.

Synchronized video watching and note-taking

The need for an integrated interface of video watching and note-taking is mainly from our own experience. There is limited research dedicated on how such integrated interface can improve the learning efficiency. However, with an integrated interface, the gap of execution is reduced, the user experience

is improved. Barger et al. prototyped a system MRAS system for annotations of streaming video on the web [1]. Although, the tool is not specifically design for integration process, they do have an integrated way to adding annotation to the video as described in the paper: Figure 1 shows the dialog box for adding new annotations [1]. As shown, it currently supports adding text and audio annotations [1]. If there is a video in the current Web page, then when the dialog comes up, the annotation's target position is set to the current position in the video's timeline, and the video pauses. [1]. Brotherton et al. presented a stream integrated Classroom 2000 project [3].

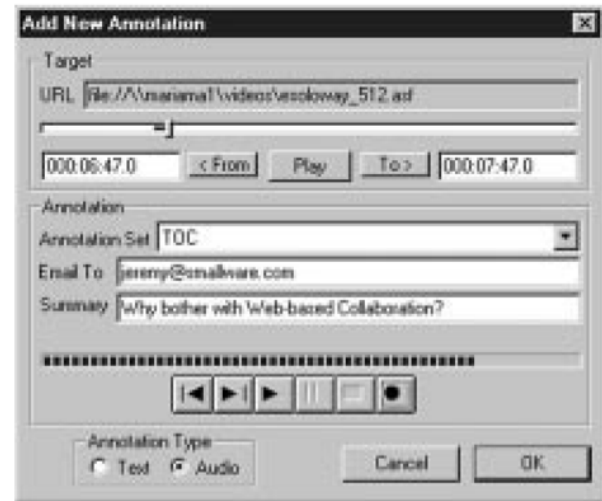


Figure 1: MRAS 'Add New Annotation' dialog box. Here, an audio annotation is being recorded. It will be added to the 'TOC' annotation set and mailed to Jeremy@smallware.com. The user has specified that the annotation is contextualized by the target video from 6 min and 47 s to 7 min and 45 s.

Easy sharing options

The easy sharing options allow for collaborative study. For example, Landay et al. carried out three related case studies of how members of a large research group sharing meeting notes [11]. Experience with using NotePals has shown that shared notes can add values to meeting, conference, and class records [11]. Landay describe how they tried to enhance this collaboration by using electronic note-taking appliances along with the NotePals system [10]. NotePals is a note-sharing system that captures and provides access to handwritten notes and documents of interest to a workgroup [10]. This paper gives an overview of the NotePals system and describes the early usage of the system for note-taking by students [10]. They have found shared notes to be useful in courses where presentation slides are supplemented with significant oral information and where students already tend to share notes with classmates [10]. In Reilly et al., they present a novel approach to applying a student-centered collaborative learning pedagogy into the lecture environment through a novel real-time collaborative note-taking application GroupNotes on Smartphones to let students voluntarily engage themselves by means of student-to-student interaction [17]. Preliminary student feedback has

shown that the approach is pedagogically and technically feasible and students are quite open to this approach due to its fun factor and peer motivation [17]. In Singh et al, they describe their system and report the findings of the user study. The data they collected validates their hypothesis that reusing text from a slide or from other users in real-time is useful to students [18]. But this experiment also shows that the system does not only improve text input; it also improves awareness among students during and after the class [18]. Many students exemplified this: they really need to see the full notes rather than keywords [18]. Furthermore, reading notes created by others was judged useful after the class [18].

TECHNICAL DETAILS

Based on the goals identified in the previous section, a web-based application is appropriate for this project. We have studied and compared multiple MVC (Model-View-Controller) frameworks including ANGULAR, EMBER and REACT. REACT is used in this project due to its outstanding compatibility with other libraries that are also used in this project. The web application – NOTETAKER – is built upon:

- **REACT** – a popular MVC JavaScript library developed and maintained by Facebook.
- **GOLDENLAYOUT** – a layout management library developed and maintained by deepstreamHub GmbH.
- **DEXIE.JS** – a minimalistic IndexedDB wrapper by David Fahlander.
- **REACTPLAYER** – a React component for playing videos developed by CookPete.
- **SLATE.JS** – a completely customizable framework for building rich text editors.
- **FILESaver.JS** – an HTML5 saveAs() FileSaver implementation using JavaScript.
- **HTML-DOCX-JS** – a JavaScript library that converts HTML documents to DOCX in the browser.
- **HTML2PDF** – a client-side HTML-to-PDF rendering library using pure JavaScript.
- **SEMANTIC UI REACT** – a UI component framework based around useful principles from natural language.

The developed application consists of two components, namely, a chrome extension and a client application. The chrome extension is only enabled when the user is in the Udacity classroom (https://classroom.udacity.com/courses/.*/lessons/). When the user clicks the chrome extension within the Udacity classroom, the extension will extract the YouTube video information from the lesson and send this information to the client app (<https://github.gatech.edu/pages/kliu99/Note-Taker>). The client will then utilize this information to automatically load the YouTube video.

Design goal 1: synchronized video watching and note-taking

To achieve the first design goal, the developed application consists of three panels: video panel, note list panel and new note panel (see Figure 2).

- The video panel has a YouTube video player that gives user basic control. It also shows basic video information including video title and video author.
- The note list panel shows a list of notes that were previously taken on this video. The notes are sorted by time in ascending order. Existing notes can be edited or deleted. Clicking on the time of the note will jump to the corresponding location of the video.
- The new notes panel allows the user to take new note on current video time. The timer inside this panel is synchronized with the video player. Once the user clicked the ‘New Note’ button, the video will be paused. The user can then start taking notes. The note editor supports markdown shortcuts (See Table 1) to improve productivity. When the user is done taking notes, the video will automatically resume.

Shortcut	Result
#	level-one heading
##	level-two heading
>	quote
1.	ordered list
-	unordered list
text	bold text
<i>*text*</i>	<i>italic text</i>

Table 1: Supported Markdown shortcuts in the note editor.

To improve user experience, the panels are full re-sizable and also allow the user to collect panels into tab mode or open panel in a new window. Figure 3 shows a few potential layouts.

Design goal 2: easy sharing options

Besides the main note-taking interface, the application also has library interface and share interface. The library interface shows a list of videos that have notes taken. It also supports notes import via JSON files and starts taking notes by providing YouTube link. Figure 4 shows the library interface. The shared interface aims to let the user view all the notes taken from a specific video in one place, and easily share the notes. Figure 5 shows such interface. The top of the interface is the menus that allow the user to export the note as JSON, Word or PDF file. Export as JSON allows the user to reimport the notes in the library interface. Export as Word allows the user to perform any necessary post editing. Export as PDF allows the user to view the notes offline.

CONCLUSION

This paper presented a note-taking web application for online learners – NOTETAKER (<https://github.gatech.edu/pages/kliu99/Note-Taker>). The application aims to allow synchronized video watching and note-taking as well as easy sharing

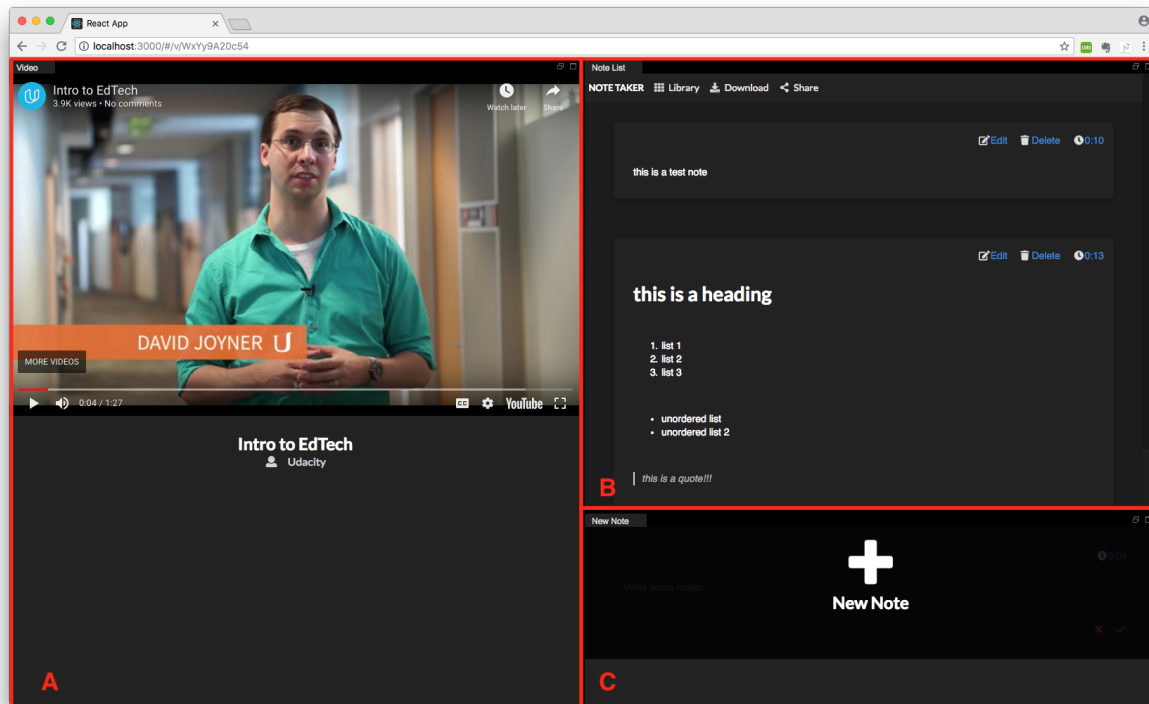


Figure 2: NOTETAKER main user interface. (A): video panel (B): note list panel (C): New note panel.

options. The application is developed using REACT and many other JavaScript libraries. A chrome extension allows the user to open the NOTETAKER and start taking notes effortlessly. The main note-taking interface has integrated video watching and note-taking. To improve user experiences, the layout is fully customizable, and the note editor has markdown shortcut support. The library interface gives a list of notes the user already taken on the machine to allow notes management and review. The share interface aims to give a comprehensive view of all the notes taken for a particular video and allows the user to export notes as JSON, Word or PDF file.

Despite the success of the developed web application, it has several limitations: (1) the notes are stored locally on user's browser storage. Changing machine or browser will lose the notes. This can be solved by creating a server and database to store and query user's notes. (2) the chrome extension currently only works for Udacity classroom. Supports to other MOOC platforms, such as edX, Coursera, can be implemented.

REFERENCES

1. David Barger, Anoop Gupta, Jonathan Grudin, and Elizabeth Sanocki. 1999. Annotations for streaming video on the Web: system design and usage studies. *Computer Networks* 31, 11-16 (1999), 1139–1153.
2. Aaron Bauer and Kenneth Koedinger. 2006. Pasting and encoding: Note-taking in online courses. In *Advanced Learning Technologies, 2006. Sixth International Conference on*. IEEE, 789–793.
3. Jason A Brotherton, Janak R Bhalodia, and Gregory D Abowd. 1998. Automated capture, integration, and visualization of multiple media streams. In *Multimedia Computing and Systems, 1998. Proceedings. IEEE International Conference on*. IEEE, 54–63.
4. Gilles O Einstein, Joy Morris, and Susan Smith. 1985. Note-taking, individual differences, and memory for lecture information. *Journal of Educational psychology* 77, 5 (1985), 522.
5. EverNote. 2018. (2018). <https://evernote.com>
6. Renée S Jansen, Daniel Lakens, and Wijnand IJsselstein. 2017. An integrative review of the cognitive costs and benefits of note-taking. *Educational Research Review* (2017).
7. Andrew D Katayama, R Neal Shambaugh, and Tasneem Doctor. 2005. Promoting knowledge transfer with electronic note taking. *Teaching of Psychology* 32, 2 (2005), 129–131.
8. Douglas F Kauffman, Ruomeng Zhao, and Ya-Shu Yang. 2011. Effects of online note taking formats and self-monitoring prompts on learning from online text: Using technology to enhance self-regulated learning. *Contemporary Educational Psychology* 36, 4 (2011), 313–322.
9. Google Keep. 2018. (2018). <https://keep.google.com/>

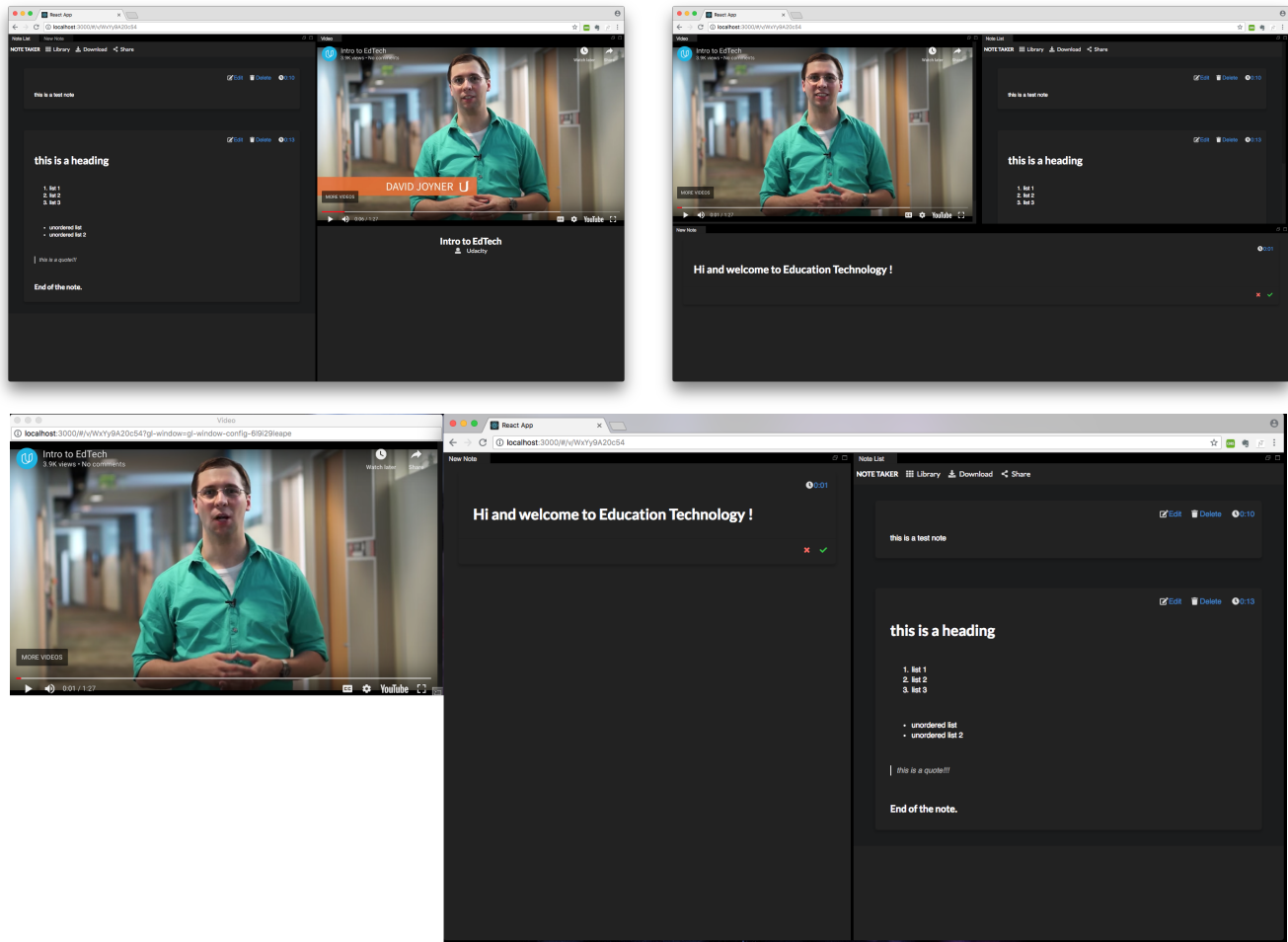


Figure 3: NOTETAKER with different layout configurations.

10. James A Landay. 1999. Using note-taking appliances for student to student collaboration. In *Frontiers in Education Conference, 1999. FIE'99. 29th Annual*, Vol. 2. IEEE, 12C4–15.
11. James A. Landay and Richard C. Davis. 1999. Making sharing pervasive: Ubiquitous computing for shared note taking. *IBM Systems Journal* 38, 4 (1999), 531–550.
12. Lightshot. 2018. (2018). <https://app.prtscr.com/en/index.html>
13. MoocNote. 2018. (2018). <https://moocnote.com/>
14. Pam A Mueller and Daniel M Oppenheimer. 2014. The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. *Psychological science* 25, 6 (2014), 1159–1168.
15. Microsoft OneNote. 2018. (2018). <https://www.onenote.com>
16. Richard J Peper and Richard E Mayer. 1978. Note taking as a generative activity. *Journal of Educational Psychology* 70, 4 (1978), 514.
17. Mark Reilly and Haifeng Shen. 2011. Shared note-taking: a smartphone-based approach to increased student engagement in lectures. In *The 11th International Workshop on Collaborative Editing Systems in Conjunction with ACM Conference on Computer Supported Cooperative Work*.
18. Gurminder Singh, Laurent Denoue, and Arijit Das. 2005. Collaborative note taking using PDAs. (2005).
19. Snagit. 2014. (2014). <https://www.techsmith.com/screen-capture.html>
20. Braun T, Klinge J, and Krom R. 2018. Greenshot. (2018). <http://getgreenshot.org/>
21. George Veletsianos, Amy Collier, and Emily Schneider. 2015. Digging deeper into learners' experiences in MOOCs: Participation in social networks outside of MOOCs, notetaking and contexts surrounding content consumption. *British Journal of Educational Technology* 46, 3 (2015), 570–587.
22. VideoNotes. 2018. (2018). <http://www.videonot.es/>

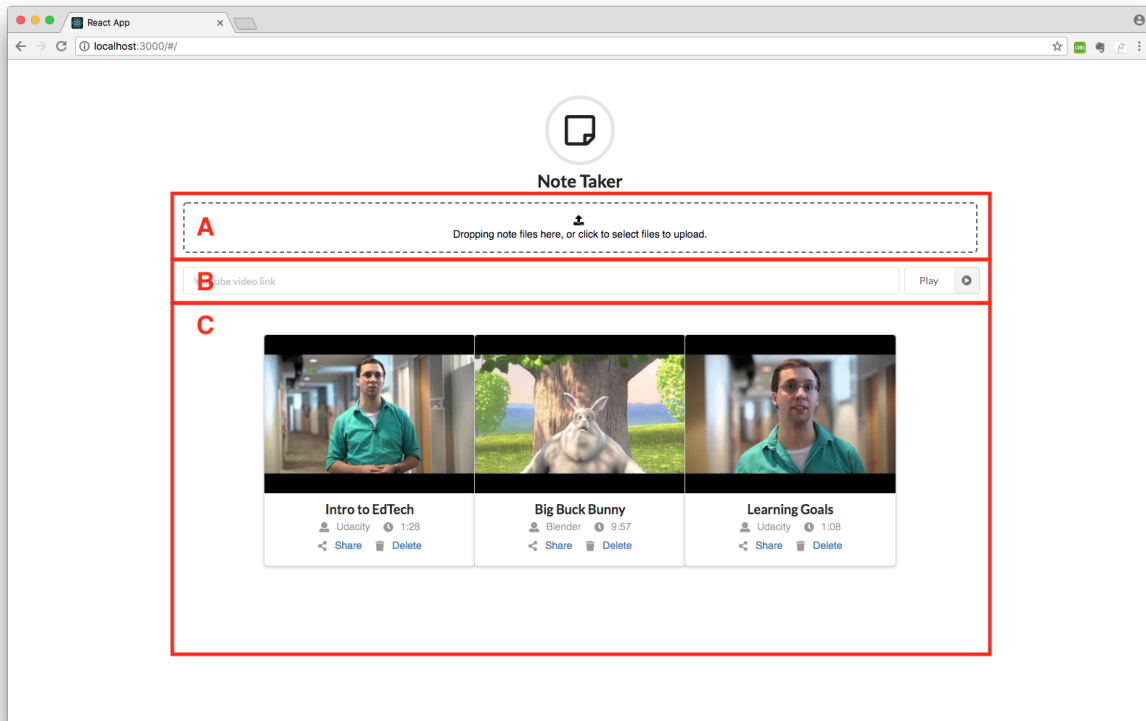


Figure 4: The library user interface. (A) Note import (B) Start taking note on a new video (C) list of notes available.

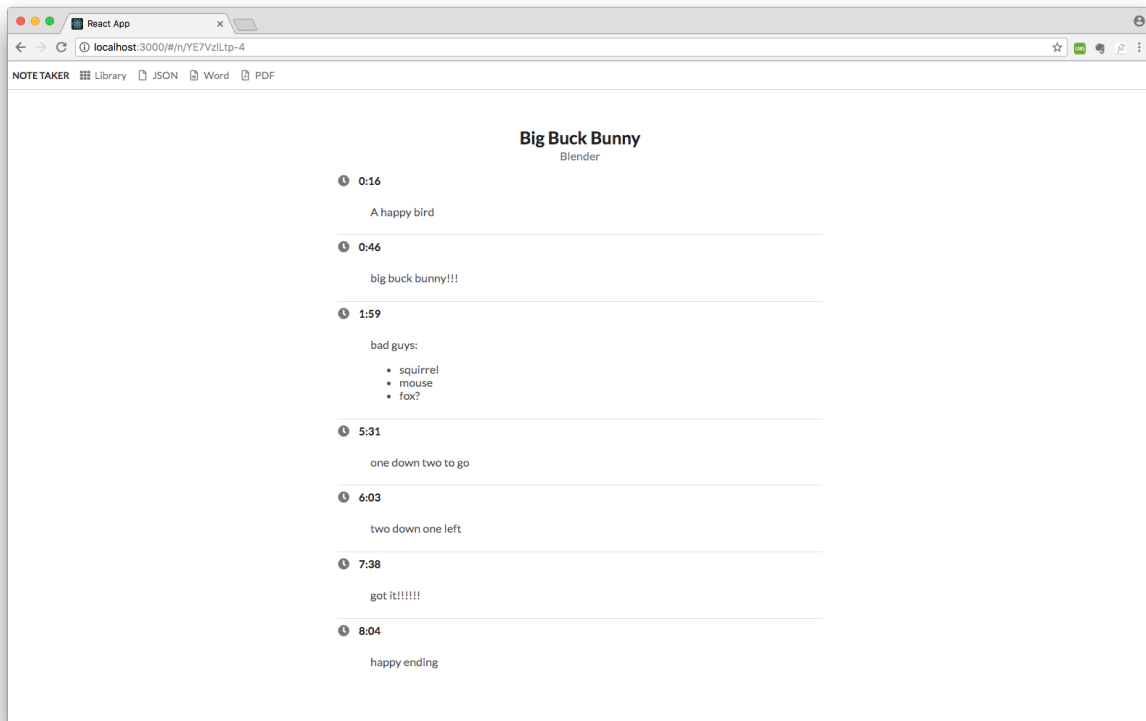


Figure 5: The share user interface.