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DIGITAL VIDEO TECHNOLOGY IN THE SERVICE OF EDUCATION: CHALLENGES, OPPORTUNITIES, AND EZSNIPS

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ABSTRACT

The rapid development of online storage systems, faster computer networks, and the proliferation of personal electronic devices capable of creating digital video files (among other factors) has resulted in the exponential growth of online digital video archives such as YouTube. The use of digital video media in the educational environment is also rapidly increasing, even in the face of significant barriers to the creation, distribution, and use of video in the classroom environment. We report herein on the development of EZSnips, an online platform and service designed for educators (and others). It enables a naïve user to avoid common barriers to video editing necessary to identify relevant intervals and to split a video into any arbitrary segment which we call a Snip, to store metadata for the Snip, and to transport that information via the Snip Link, a single URL, that may be inserted into any web-compatible program, including for example, PowerPoint, Office applications, and web pages. Upon clicking the Snip Link, a new browser window will open on the web-compatible client device, call the EZSnips server which will then play the Snip. EZSnips is also designed for collaboration among the user community who can create added value by entering metadata describing the video Snip, and by the voting of favorites. EZSnips has been selected as a potential start-up in the class of 2011-12 by the statewide competition, Alabama Launchpad.

INTRODUCTION

The higher education classroom has undergone radical transformations during the age of “personal” computers due to the displacement of traditional techniques for classroom instruction by the decreasing costs of personal computer technology and campus infrastructure. In many classrooms, words summarizing the spoken lecture are still written in chalk or markers on frontal boards, but may now be supplemented by computer projections of PowerPoint slides, animations, digital video (movie) files, and display of live web assets.

One of the fastest growing segments of the online video market lies within what’s called the “E-learning” market which includes the deployment of digital video in schools and classrooms, and distributed for the distance learning environment. Factors that promote the growth of digital video in the E-learning market include the building out of campus infrastructure computer networks, including wireless networks, the installation of computers and network cabling to “smart” classrooms, the increasing portability of computers (e.g., laptops, ultrabooks, tablet computers and iPads, etc.) and transportability of digital media (USB flash drives), and the accessibility of online storage from the classroom podium through the World Wide Web (Web).

With the increasing deployment within educational institutions of hardware, software, and computer networks, the ability of an instructor to incorporate digital resources into the classroom environment has dramatically increased (but this alone does not guarantee an automatic increase in pedagogic quality, of course).

The increasing quantity of digital video assets available, at least for viewing through a Web browser, is truly staggering. In January, 2012, it was reported that uploads to Youtube reached one hour of digital video per second, and that four billion videos in the archive were viewed per day (Kupka, 2012).

Although one might presume that a high percentage of the world’s largest video archive has little pedagogic value, the fact that the archive is so large means that even if only a trivial percentage is relevant to classroom subject content (say 0.5 percent), the number (as of Jan. 2012) of potentially relevant videos is 20,000,000. Such a resource cannot be ignored, and opportunities for exploiting this vast repository are legion.

With opportunities, however, come challenges. Some of these originate with the structural organization of the archive itself, others with tools for search and retrieval, and still others with barriers to accessibility and deployment in the classroom. Unfortunately, the growth of online digital video assets has overtaken the development of tools for search, retrieval, and deployment of video in the classroom environment.

DESCRIPTIONS OF SOME BARRIERS TO DEPLOYMENT OF TECHNOLOGY

A number of barriers make the deployment of digital video media in the classroom a difficult process for the larger population of teachers who lack numerous technical skills and experience. Some of these barriers are characteristic of hardware, others of software. We will discuss the more important and common barriers originating with the underlying form in which file data structures are encoded and packaged. Our perspective will be that of a typical (non-expert) end user of video services in education to highlight the most relevant issues, not that of experts, such as network or software engineers, or of professional video producers.

Video (movie) files are comprised of multiple parts, such as audio and video data, packaged for streaming transmission to, and display on, a user's device, typically today a desktop, laptop, tablet computer, or smartphone. In the classroom, the most common client device is a desktop computer or a laptop connected to a projector, and for classroom instruction, PowerPoint as client presentation software. We will also concentrate our focus on YouTube, the largest online video archive to date.

For better or worse, PowerPoint is probably the most common presentation software system used in the educational environment today. As a consequence, when an instructor wishes to use a YouTube video in the classroom, one must consider how video may be used inside, or in conjunction with, PowerPoint.

Barriers caused by file formats: Prior to PowerPoint 2010, incorporating video inside PowerPoint required considerable knowledge and technical skill, barriers that prevent many users from exploiting the power of video in their presentations. For example, Microsoft lists seven major categories of reasons why a movie may not play inside PowerPoint 2007 or before (Microsoft, no date), including movie files incompatible or unsupported file format, improperly linked, excessive length of file name, etc. For example, PowerPoint capabilities include only a limited number of native, multimedia container formats (e.g. AVI, WMV, MP4, etc.) and PowerPoint cannot directly read many others (MOV, DivX, MKV, etc.).

These limitations on video file formats compatible with PowerPoint 2007 can be overcome, with difficulty by the naïve user, with software that can transcode a video file from one format to another. However, many of these programs are not without cost, and although the time it takes to produce a transcoded file falls with increasing use, the learning curve for such processes is a significant barrier for the majority of instructors.

That these procedures are pain points preventing the more extensive use of video in the classroom presentation environment is documented by the fact that Microsoft has finally included some tools for managing video inside the PowerPoint 2010 environment. For example, PowerPoint 2010 now has the ability to read MOV and SWF files (provided the players for these file formats are installed on the client computer). In addition, a number of functions for editing a video (trim, special effects, brightness/contrast, etc.) are now available inside the Media Manager. These editing functions, however, cannot be applied to media of particular formats, such as the streaming media from YouTube or SWF formatted files.

So even with these widely desired and enhanced functions for using video inside PowerPoint 2010, a less sophisticated user remains unable to exploit the power of YouTube's vast repository of video

Although YouTube videos (Flash objects) can be embedded as links in PowerPoint, the procedure for doing so involves a series of technical steps that requires user interaction with the PowerPoint developer ribbon, and the manual cutting/pasting and editing of a portion of a URL with the attendant potential for typing mistakes and other errors.

That these procedures (and others) are pain points preventing the more extensive use of video in the classroom presentation environment is documented by the fact that Microsoft has finally included some tools for managing video inside the PowerPoint 2010 environment. For example, PowerPoint 2010 now has the ability to read MOV and SWF files (provided the players for these file formats are installed on the client computer).

Barriers caused by lack of collaboration tools: It is also important to recognize that these enhancements engineered for PowerPoint 2010 are built for the individual user. There is no PowerPoint system architecture for assembling, managing, and collaborating with colleagues on a common library of video assets. It's as if Microsoft's vision for using video inside PowerPoint was narrowly focused on satisfying only the immediate user demands for more function buttons, while ignoring the broader issue of community collaboration architecture. That is, Microsoft failed to recognize the demand and desire for social collaboration functions seamlessly integrated into their flagship products.

EZSNIPS – A MULTI-FUNCTION TOOL FOR USE OF DIGITAL VIDEO RESOURCES IN THE CLASSROOM (AND ELSEWHERE)

The barriers previously discussed that inhibit the use of online digital video resources stimulated the authors to conceive of, and build, a software system, EZSnips, with capabilities to overcome at least some of these barriers. In designing a video archive software system for educators, we assigned the following client-side functionalities higher priority.

- capable of minimizing the user's time and knowledge required to create a video link,
- capable of referencing a video from an archive via a single URL link,
- capable of designating videos as public or private,
- capable of accumulating user opinions of video entries,
- capable of hierarchical classification of video metadata,
- capable of easy filter, search and retrieval,
- capable of playing video via a device-independent player.

Generalized system architecture: The EZSNIPS system architecture is based on three technological components: database, scripting languages, and the web server (Fig. 1). Microsoft Access database (MDB) is used to store, manage, and retrieve data. , SQL and ODBC are components of the database management system used together to specify data organization and relationships, and to ensure performance, availability, and security. The authors acknowledge the theoretical and demonstrated shortcomings of the widely used MD5 algorithm (Garcia, 1997), but use it with ASP for its simplicity and support of 128-bit (16-byte) encryption (Stevens, et. al., 2009).

Active Serve Page (ASP), known as classical ASP, is the main scripting language used for this project. ASP is the server-side programming technology developed by Microsoft and runs on Web servers to dynamically generate Web pages. Pages with the ASP file extension are run each time when a client makes a request or accesses the site from a dynamically generated Web page. The output of server-side scripts are generated in HTML file format and sent to the client's browsers. The most important advantages of this technology are easy programmability, execution on server machine, and availability in Internet Information Services (IIS) server (Homer, at al., 1997).

Java Script (JS) is used for, and executed in, the client. JS controls display features, objects and elements of the browser. Advantages of this technology include client-side processing of scripts, thus speeding execution and increasing page loading (Homer, at al., 1997). In this project, JS is also used to control the flash player, JW Player. JW player is one of the most-commonly used open source flash and HTML players, and it supports many types of video and audio formats (e.g., .mp4, .m4v, .f4v, .mov, .flv, .ogv, .aac, .m4a, .f4a, .ogg, .oga, .mp3), YouTube, HTTP, and RTMP streaming, and various XML playlist formats. It is also includes configuration options and JavaScript API for control of the player.

Cascading style sheets (CSS) is used in this project to control the appearance of web pages written in HTML. CSS includes a set of guidelines that is used to specify the style of elements of document, such as font, size, color, and place of text and image, or even to create an animation within the HTML page. The most important advantage of using CSS is its ability to share formatting in multiple pages and to reduce complexity by separating the document style from document content.

Microsoft virtual dedicated server (VDS), also known as virtual private server, is used to authenticate requests coming from the client. The software for each VDS includes a web server, a file transfer protocol program, and an email server program. The primary function of a web server is to communicate content to and from the client. Most web servers support server-side scripting, such as ASP, PHP, Perl, and client-side scripting, such as, JS and CSS.

Functionalities of EZSnips (client side): The core function of EZSnips is to create a link from which an entire online video file, or any arbitrary part of a video file ("Snip"), may be played in a device-independent (Web compliant) browser. We'll discuss the functionalities of EZSnips in the order in which a user would normally invoke the functions. At present, EZSnips can access only two video archives – YouTube and the UAB Wowza streaming media server. The following example will be limited to the YouTube server.

Creating a Snip (Fig. 2): After a user has located a video resource of interest in the YouTube archive, the user simply copies the URL of interest and pastes it into the EZSnips entry bar (Fig. 1, #1). The server then retrieves the video file from the YouTube server and displays it in the built-in player (JW Player). The user watches the video as needed, and notes the interval to be captured. This interval of interest is then specified by the user sliding the two round selection buttons, one from the left to mark the beginning point of interest, and one from the left to mark the ending point of interest (Fig. 1, #2). After the interval of interest, the Snip, has been identified, the user clicks the scissors icon (Fig. 1, #3), and the system records these in and out points in the database.

Tagging a Snip (Fig. 3): A video Snip can be associated with a number of metadata by clicking an icon (Fig. 3, #4). Input fields are provided for a number of different types of metadata (Fig. 3, #5). Three input fields are provided for a hierarchically organized classification (categories). One free-format input field is provided for a description. One free-format input field is provided for keywords (multiple entries permitted). Check boxes are provided for Settings, including Autoplay, Visibility (keep video hidden, or not, in the public library), and an import function for the automatic importing of YouTube metadata for Description and Keywords.

Publish a Snip to the Library(s): A video Snip is published to the user's private library (and optionally to the public library via the Hide/No Hide Setting) when the globe icon is clicked (Fig. 4, #6). This action generates an image based on the first frame of the video, and it is displayed as an icon in the filmstrip library view (Fig. 5).

Options for modifying the video Snip entry: A library entry may be altered in a number of ways using clickable icons on the filmstrip image (Fig. 6). A red heart icon is provided for the tagging of the Snip in a Favorites database field, so that desirable entries may be quickly filtered from the database. A green plus icon displays a menu of additional functions, including the ability to edit, delete, or hide a Snip. There are also placeholders for functions not yet activated.

Options for query of library database: A library (public or private) may be filtered or searched (sorting is not yet implemented) (Fig. 7) in order to locate a Snip(s) of interest. For example, Search may be done on user input of User name, Description, Keyword(s), or Category(s).

Retrieval of Snip metadata: Once a Snip of interest has been retrieved from the database, it is displayed in the player, and metadata are shown, including Category, Description, and Keyword entries. Also shown are time values for the Snip, including the in and out points and the total length for the Snip. A clickable icon "Get Snip Link" reveals the URL for the Snip (:Snip Link") (Fig. 8).

Exporting function for the Snip: After the Snip has been created and entered into the library(s), a user may access the Snip by its URL, available by copying the Snip Link (Figs. 8, 9).

Use of Snip Link in PowerPoint: A Snip may be used in PowerPoint by pasting its URL, the Snip Link, as a hyperlink. For example, in Fig. 10, an image from the source video has been pasted onto a PowerPoint slide. From the PowerPoint Insert menu, the Hyperlink menu provides an Address bar into which the Snip Link is pasted, associating the Snip with this slide object. During the presentation, when the associated object is invoked, a new browser window is automatically opened, the Snip Link is loaded into the browser, and the Snip is retrieved from the library and played between the in and out points (Fig. 11).

DISCUSSION

As educators, we have extensive experience with the use of computer video technology in the classroom. Although the technology for deploying video in the classroom has been developing rapidly, in our experience, the core function needed in the classroom by the instructor – the ability to quickly access just that relevant portion video and play it at an appropriate point during a class – has not yet been delivered.

Video editing functions are needed to alter the play of a video, and a multitude of video editing programs are available, either paid or free, installed client-side or for online use, from simple GUI interfaces to programmable, with client-side or server storage. However, these standalone programs fail to fulfill the core need we have identified above, because (in part) of the following:

- multiplicity of formats and wrappers (file containers) for video and other multimedia data,
- limitations of PowerPoint presentation software and other players,
- expense and/or complexity of programs,
- steep learning curves required for a user to become knowledgeable about these and many other multimedia issues.

EZSnips is being developed to overcome these and many other, barriers to the deployment of video resources, especially in the educational environment. Because EZSnips is built for server-side computation, and significant burdens have been reduced for the client. For example, user knowledge of the entire class of video editing client software has been eliminated, along with any need for understanding of video formats and wrappers, transcoders, codecs, and other arcane components of these complex technologies.

EZSnips is built as "Software as a Service" (SaaS), and so resides on the EZSnips server. Its core function is to enable a user to select pedagogically relevant items from the vast YouTube video archive, specify and store those specific intervals of greatest value, and transport that information via a simple URL, the Snip Link, to any web and browser compatible environment, all within a GUI interface that requires no programming, program installation, or advanced knowledge of multimedia file technology.

EZSnips does not store video on the server – it only creates the Snip Link, a URL, based upon the user selection of in and out points in the video, and stores this information in its database. When invoked, EZSnips calls the source archive (in this case, YouTube), begins the streaming from the YouTube server at the user-designated in point, and stops the video at the user-designated out point. The streaming occurs through the EZSnips server to the client browser.

Device-independent portability of Snip Links: The creation of the Snip Link is a key to the portability of this service. The Snip Link is a URL that can be inserted into any web-compatible asset, such as a PowerPoint file (through the Insert/Hyperlink command), an Office Document (such as Word or Excel), a web page (through HTML), etc. On the invocation of the URL, a new browser window will open, send the request to the EZSnip server which will retrieve the necessary information from its database, and then play just that Snip in the JW Player in the browser window.

Collaboration adds social value to EZSnips: Collaboration is a social activity, and social media are a significant part of the popularity of Facebook and other online systems. As educators, we recognize that although each of our lectures is unique to us, many of the resources we use probably are of common interest to colleagues in our respective fields. So, for example, in most introductory classes in geology, there will be a discussion of volcanic activity. Among the vast video resources on YouTube are large numbers of videos showing volcanic eruptions (12,700 returned from the keywords "volcanic eruption", March 23, 2012). Perhaps most of these would not be suitable for classroom instruction because of poor quality, irrelevant content, etc. However, should one geology instructor find a suitable video, even of great length, with a short segment that shows a high quality, relevant perspective of a volcanic eruption, then that segment becomes valuable after its discovery. An entry of this item into EZSnips then makes this Snip available in the EZSnips public library to the general community of colleagues, if so designated by the user.

With a larger community of contributors to the EZSnips library, a collection of Snips continually grows in size and relevance. Metadata add value to these items, because the contributors are knowledgeable about the subject portrayed in the Snip.

One function used to engage "quality control" in EZSnips is the availability of the use of Favorites by users of this system. One would suspect that although a contributed video has already passed the user's requirements for quality by selection from the YouTube archive, those individual assessments of quality may not be widely shared. As the community of users "votes" on the usefulness of a Snip, its value is modified in proportion to the votes it receives.

Commercial and future development of EZSnips:

Although at present its video editing capabilities are limited to the core function of creating Snips, other editing functions are planned in future development. We are also developing interfaces to other video repositories, and we are working with several companies as we explore the commercial potential of EZSnips. EZSnips has been selected as one of 15 projects statewide (Alabama) by the Alabama Launchpad competition for its class of 2011-12 (EDPA, 2012).

Importance of transdisciplinary collaboration: EZSnips was conceived during collaboration between a geologist and a computer technology/education specialist who have the intersecting interests of solving problems of common concern, such as the uses of technology in education, thus reinforcing the validity of transdisciplinary strategies to overcome isolating barriers that separate academic disciplines. We believe this type of effort will only become more important as systems of problems become more complex, particularly in areas of science and technology.

CONCLUSIONS

Vast video resources are present online, and with these large numbers the promise of pedagogically relevant material becomes nearly certain. Finding, assessing, and using video resources in the classroom has been impeded in part by numerous barriers of technology between the location of the video resource and the live lesson in the classroom. EZSnips is being developed as "Software as a Service" (SaaS) to enable an educator to create an arbitrary Snip of any video from pedagogically relevant items discovered in the vast video YouTube archive, store those specific intervals of greatest value, and transport that information via the Snip Link, a simple URL, to any web and browser compatible environment, all within a GUI interface that requires no programming, program installation, or advanced knowledge of multimedia file technology. EZSnips also provides an environment in which educators can collaborate and share video resources, with a mechanism for voting favorites, thus creating educational value added by experts in a field.

This model established for the use of video digital video resources from archived repositories with educational value does not preclude application to other communities of specialists, or even the general public.

ACKNOWLEDGEMENT

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FIGURES AND TABLES

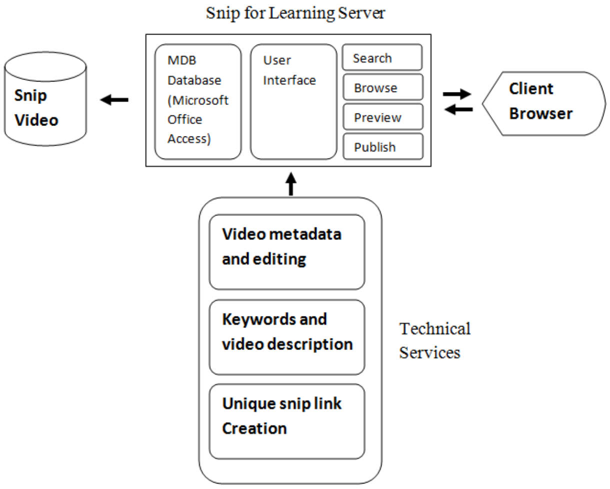
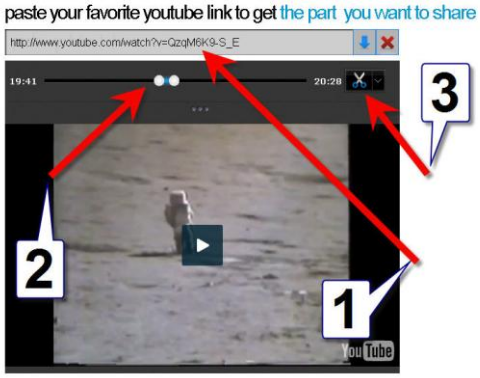

Snip for Learning Server
Snip Video
MDB Database (Microsoft Office Access)
User Interface
Search
Browse
Preview
Publish
Client Browser
Video metadata and editing
Keywords and video description
Unique snip link Creation
Technical Services

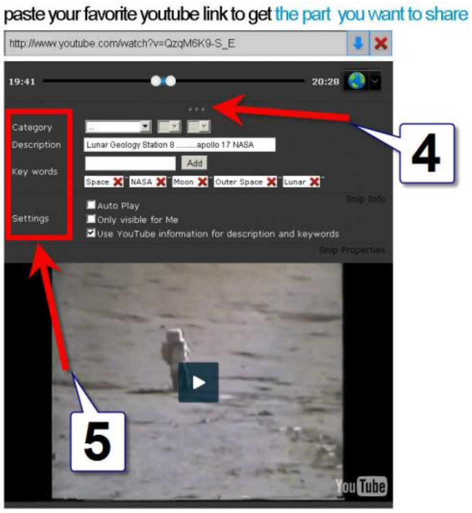
Fig. 1 System Architecture



paste your favorite youtube link to get the part you want to share

http://www.youtube.com/watch?v=QzqM6K9-S_E

Fig. 2 YouTube video resource URL paste function into EZSnips



paste your favorite youtube link to get the part you want to share

http://www.youtube.com/watch?v=QzqM6K9-S_E

Category ...

Description Lunar Geology Station 8 ....apollo 17 NASA

Key words Add

Space ✕ NASA ✕ Moon ✕ Outer Space ✕ Lunar ✕

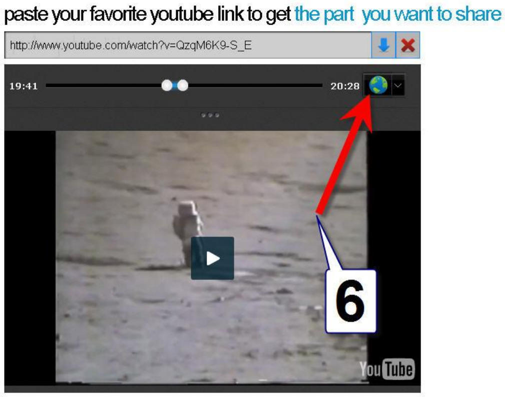
Settings

□ Auto Play

□ Only visible for Me

☑ Use YouTube information for description and keywords

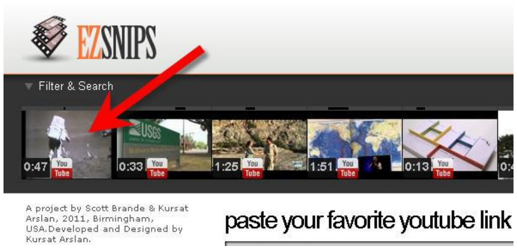
Fig. 3 Dropdown icon exposes fields for entry of metadata for classification, and later search and retrieval and filter functions



paste your favorite youtube link to get the part you want to share

http://www.youtube.com/watch?v=QzqM6K9-S_E

Fig. 4 Publish function initiated by user click on globe



A project by Scott Brande & Kursat Arslan, 2011, Birmingham, USA.Developed and Designed by Kursat Arslan.

paste your favorite youtube link

Fig. 5 Video snip icon shows the link has been added to library

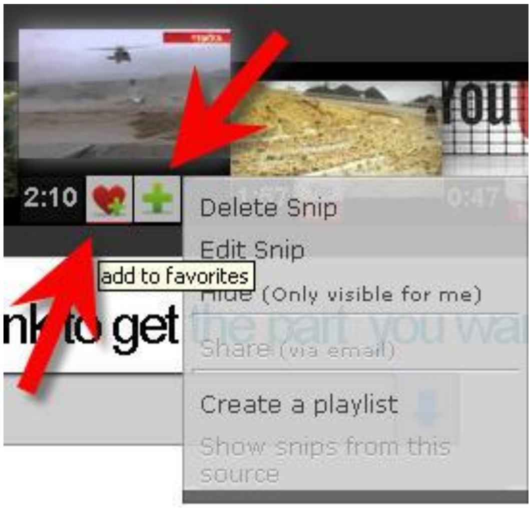
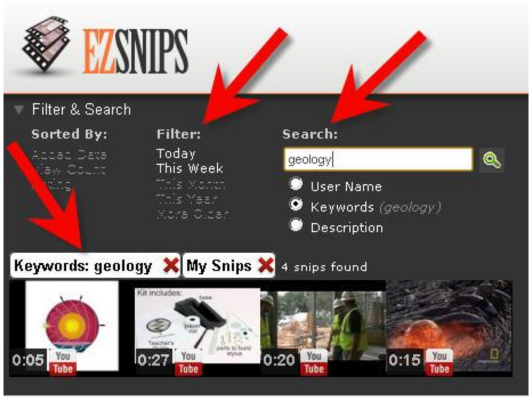


Fig. 6 Snip editing functions include tagging for Favorites, hiding, deleting, and playlist creation

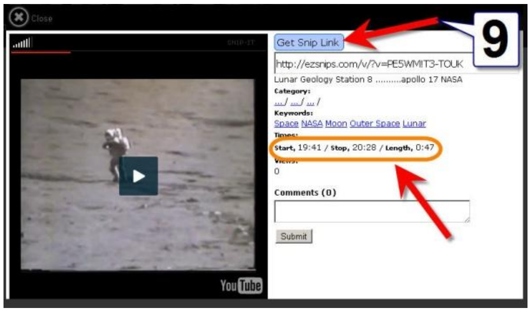


Search: geology

Keywords: geology

4 snips found

Fig. 7 Snip library may be sorted, filtered or searched



http://ezsnips.com/v/?v=PE5WM!T3-TOUK

Lunar Geology Station 8 ....apollo 17 NASA

Category:
.../ .../ ... /

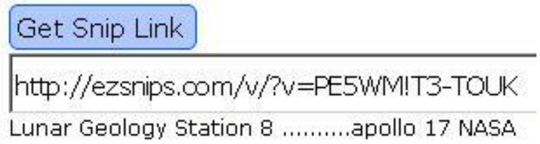
Keywords:
Space NASA Moon Outer Space Lunar

Times:
Start, 19:41 / Stop, 20:28 / Length, 0:47

Views:
0

Comments (0)

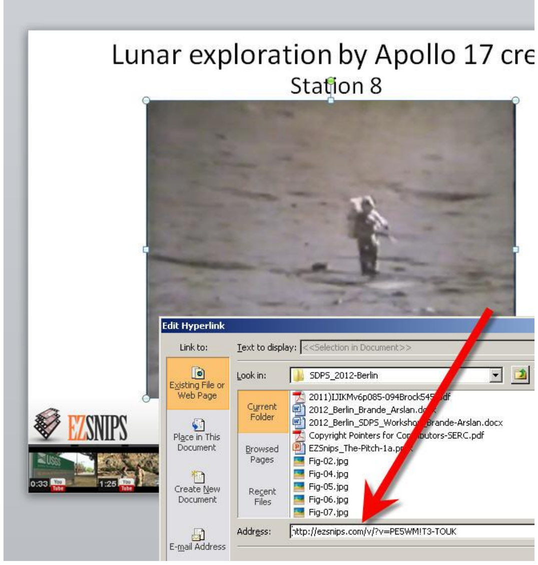
Fig. 8 Snip link and descriptive information is retrieved from the library



http://ezsnips.com/v/?v=PE5WM!T3-TOUK

Lunar Geology Station 8 ....apollo 17 NASA

Fig. 9 Snip link is copied for use in other Web-compatible environments



Lunar exploration by Apollo 17 cre
Station 8

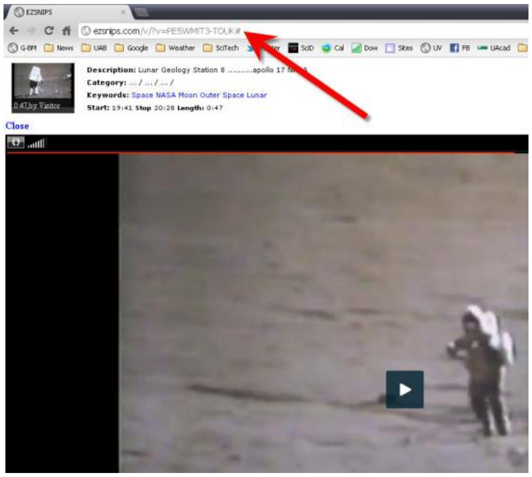
Text to display: <<Selection in Document>>

Look in: SDPS_2012-Berlin

2011)IJIKMv6p085-094Brock545.pdf
2012_Berlin_Brande_Arslan.docx
2012_Berlin_SDPS_Workshop_Brande-Arslan.docx
Copyright Pointers for Contributors-SERC.pdf
EZSnips_The-Pitch-1a.pptx
Fig-02.jpg
Fig-04.jpg
Fig-05.jpg
Fig-06.jpg
Fig-07.jpg

Address: http://ezsnips.com/v/?v=PE5WM!T3-TOUK

Fig. 10 In PowerPoint, Snip link is pasted as a hyperlink



ezsnips.com/v/?v=PE5WMIT3-TOUK#

Description: Lunar Geology Station 8 ....apollo 17 NASA

Category: ... / ... / ... /

Keywords: Space NASA Moon Outer Space Lunar

Start: 19:41 Stop 20:28 Length: 0:47

Fig. 11 Upon activation, the SnipLink opens in a new browser window and the Snip plays automatically