Edumate: A case for a free pervasive mobile application in collaborative educational instructional content building

Varun Arora
Carnegie Mellon University
PO Box: 24866
Doha - Qatar
+974 7758 2786
me@varunarora.com

ABSTRACT

This paper introduces the features, technologies, metrics and possibilities for an experimental yet ambitious tree Android mobile device application titled Edumate for use in educational K-12 instructional content building by the community, a concept very close to the idea of participatory video. The paper also highlights how the pervasive and human interaction aspects of this relatively simple application are the reasons for higher likelihood of adoption.

1. INTRODUCTION AND OPPORTUNITY

A series of computer science research scholars, including Mark Weiser and M. Sathyanarayan, have made the case for the possibilities and versatility of mobile and pervasive (or “ubiquitous”) computing in the past 20 years. Various scenarios, such as a virtual assistant in the office to ones with portable on-the-move data, have been envisioned and processes for the same have been drawn out on storyboards. While all of these scenarios are large-usage data generators for applying intelligence to, not much work has been done in understanding pervasive applications in meaningful collaborative content creation. Also, while the Information & Communication Technology and Development (ICTD) community has repeatedly developed projects where community involvement in building knowledge is at the core of the solution, it is not common to see very pervasive scenarios in these projects. One of the major reasons for this is that pervasive computing comes at a cost f and whenever there has been major emphasis on low-cost solutions, pervasive computing has been the easiest component to eliminate.

Looking from an educational technology perspective, we know that since the boom of education technologies in the late 1990s, introduction of technology in the process of instruction and delivery has become more and more common. Increasingly, we see advancements in quality of projectors, document cameras, presenting gadgets, tablet PCs, learning management systems, administration systems, etc. Much of these technologies support the top-down process of knowledge delivery. Sadly, pervasive computing has not been a very strong intent during the production of these technologies, or what it supports in building - knowledge content.

With the rise of Wikipedia and social networks, however, the paradigm of information sharing is shifting to something where knowledge is built more collaboratively. The pace at which information is shared in this new world is extremely quick, and refuses to discriminate against any willing contributor, yet manages to maintain high moderation standards and build very high quality content. Senior academics are increasingly realizing this phenomenon, and rather than resisting it, are exploring the possibility to harness lessons learned from many such examples and apply them directly in building content for their fields.

So if there is a clear global trend of using collaborative platforms to share knowledge, and the academic community is realizing its potential and ability, why isn't high-quality content being built collaboratively reaching students in most K-12 schools and higher education institutions? I identify four reasons for the same (See Appendix A). While some of these have more severity than others, they all are in some sense problems we need to tackle in order to get high-quality content to classrooms.

To “multiply the intent” (Toyama, K., 2010) of educators and academics interested in building content in a collaborative way, I have attempted to tackle the problem of slow and immature digital content development by proposing and building a truly pervasive Android application titled Edumate, to allow educators and content collaborators to build and openly & freely share video content of instructions in their respective domains. With the increasing penetration of mobile devices equipped with high-quality cameras, GPS and 3G/4G capabilities, and running the Android OS, the possibility of gaining momentum with a large number of users and contributors using this application is extremely high.

2. NEEDS ANALYSIS

In proposing this application and eventually building it, there wasn't much communication or discussions with educators, which makes the research behind this application incomplete. However, all the necessary insight into understanding what components and aspects that were developed as a part of this application were a result of readings and study into the area of educational and instructional technology, along with knowledge of best practices from the Information and Communication Technologies for Development '09 Conference. Here is a partial list of needs identified in this process:

1. K-12 teachers in most schools in developing countries lack access to school-owned technology or network services in classrooms. In cases when these schools are located in urban areas, and otherwise have access to such technology and information services outside school, teachers realize the opportunity lost without these technologies and often believe in its potential in classrooms.

2. In many developing countries, poor curriculum produced by the national education system and limited flexibility in course planning is enforced on to educators, leaving little room or scope for these teachers to deliver enhanced well-paced lectures in classrooms. Also, with the lack of provisions in the system to build networks and content freely and openly, students continue to rely on poorly designed textbooks. As a result, privately-run
tuition services outside schools soar. It is very likely that in the presence of a free knowledge-sharing network or program, teachers would be able to produce much finer course material and share the same with fellow educators.

3. Collaborative information aggregation and knowledge building have proven to drive the information industry in the past decade. Capturing and sharing organizational tacit knowledge has become a compelling investment for a lot of large organizations. YouTube, Facebook and Wikipedia are quickly becoming key platforms for making any news/information viral. Research is being pursued to bundle social networking experiences with learning. There is still a lot of work to be done in designing products that integrate in the learning process.

3. STATE OF COMMUNITY VIDEO CONTENT PRODUCTION A.K.A PARTICIPATORY VIDEO

According to the handbook titled Insights into Participatory video (Lunch N & C, 2006), participatory video is defined as follows:

“Participatory Video is a set of techniques to involve a group or community in shaping and creating their own film. The idea behind this is that making a video is easy and accessible, and is a great way of bringing people together to explore issues, voice concerns or simply to be creative and tell stories. This process can be very empowering, enabling a group or community to take action to solve their own problems and also to communicate their needs and ideas to decision-makers and/or other groups and communities.”

As empowerment is not a very big challenge in urban societies, participatory video is gradually gaining momentum into developing societies' projects - where there is a lack of adequate systems, economic activity, infrastructure and policy. Moreover, many ICTD projects are now being directed around this concept. Edumate is an attempt to use participatory video to address the challenges of poor instructional content production from educational content planners and publishers across the world. Video has been chosen as a medium because of its ease in production from mobile devices, user appeal and its viral and pervasive nature.

4. THE APPLICATION

In the following section, I discuss the features of the application from a user perspective, followed by the technologies used to support building the application.

4.1 Features

Edumate is an experimental application built for the Android platform to allow K-12 educators and students from around the world to record and upload short subject-related video instructional clips on to an open, free and unified video repository (with multiple channels) with ease, and view similar content created by other education enthusiasts. The strength of the application lies in its pervasive nature, openness and simplified process.

4.1.1 Browse content

Users of the application may or may not create/upload new content. As mentioned above, all users can view video content created and uploaded by other contributors to different channels of the video repository. These videos are categorized according to the domain they fall under. For the target audience of this application, the different domains are the various subjects taught in K-12 schools. The application currently does not have a search functionality for something that will be incorporated in revisions to follow.

One of the key components of the application that makes it pervasive is its ability to filter video results based on the user's current location and a user-specified radius ring of results. The application first captures the current GPS coordinates of the device running the application (by accessing the OS API) and then accesses the settings of the application for the value of the radius range in which the user is looking for results in. It then looks for videos within this specified range i.e. videos that have geolocation coordinates meta-data associated with them and falls under the user-specified limit, and returns this list to the user.

For example, a teacher in a classroom may be interested in video content being uploaded by other teachers in her town/district. To get video content from the region, she may access the Settings of the application and set her radius ring to 60km. This will return a list of video clips that have geolocation data associated that falls under 60km radius of her classroom (or her home, depending on where she may want to access the application).

4.1.2 Upload content

The other core component of the application allows the users to either record new videos and upload or directly upload pre-recorded video clips on the application to the content repository at ease. Figure 1 shows the screen and list of options that the user sees after selecting or recording the video to be uploaded. The user may give a title, a description, choose the subject area, and add associated arbitrary tags to the video. Meanwhile, the application pulls from the device the current GPS latitude and longitude coordinates and associates these as geolocation meta-data to the video being uploaded (which forms the backbone to browsing video clips, as described in the previous section). All these videos get uploaded seamlessly over the most reliable wireless network services in use: WiFi or 3G/4G/XG.

Figure 1 shows the various fields a user is expected to enter while uploading a video clip, while the application fetches the user's geolocation.
4.2 Technologies

4.2.1 Authentication

In order to reduce the amount of effort and application-specific processes before a user can start viewing and uploading video clips, it is vital to simplify the registration process. It cannot be eliminated, however, because it allows moderation to be practical and possible by making content creators accountable for their video content. For Edumate, it was realized that it wasn’t necessary for the application to require completely new authentication details or undertake aspects of user management because of the options offered by the Android SDK. The Android SDK allows any application to leverage what it calls AccountManager to make calls to ready-made functions to handle user authentication into Google or Facebook accounts. This means that all the aspects of security, integration and user profile management are already handled by the Android OS, and developers can take advantage of this by accessing all this from a AccountManager utility in the SDK. This feature also proved to become a very big advantage in the architecture of the application, as it now provides authenticated Google/YouTube users to upload video content as opposed to anonymous users with profiles on our database. The next section sheds more insight into why this has been crucial.

![Figure 2. An example of a user logging into the application with their existing Google account, a process handled by Android 2.2’s AccountManager](image)

4.2.2 YouTube Direct

YouTube Direct (http://code.google.com/apis/youtube/ytdirect.html) is an open source application written by Google engineers to allow website administrators to manage and moderate YouTube user submitted video content on a integrated interface, and place it in various playlists.

In the first developed version of the eco-system of Edumate, I use an instance of this application to accept video submissions from various users of the mobile application to specific assignments. This instance allows for reviewing, moderating and managing these videos and its assignments in a simple process. As a result of actions performed on this, changes are reflected on the YouTube channels of the content repository (which is simply a single YouTube user with a massive video upload limit). One of the limitations of using this approach is the upload restrictions YouTube poses to individual users. That said, most organizations and educational institutions have been successful in securing accounts for organizations that get over these restrictions.

Fortunately, it was easy to get started with using the client version of YouTube Direct as there is a Google code application project specifically for Android called Ytd-android (http://code.google.com/p/ytd-android/).

4.2.3 YouTube Video API

One of the major reasons why so many applications and mashups are built around YouTube videos is because of its robust, extensive and well-designed API. YouTube API (http://code.google.com/apis/youtube/overview.html) is extremely well documented and very easy-to-use for beginners and advanced developers alike. Much like RSS for blogs, most common use of the YouTube API does not require any form of authentication.

Edumate taps upon the power of this API to run make calls that filter based on users, channels, playlists, and geolocation associated with the videos themselves. Easily constructed URL calls return well-structured XML or JSON data which is then harnessed by the application to present lists of videos as native Android lists and application objects.

4.2.4 Google App Engine

Google App Engine (GAE) (http://code.google.com/appengine/) is a free (to begin with) cloud service offered by Google to allow developers to host easy-to-scale applications on Google's infrastructure. It was an obvious choice for hosting the YouTube Direct web application instance because of several reasons:

1. YouTube Direct has been written in Java and is designed to run in GAE. Also, the current installation documentation has been written specifically for installation on GAE
2. GAE allows the instance to authenticate into administrative (or moderating) Google accounts with an interface that looks more native to Google products
3. It is scalable, Bee and very easy to get started off with.
4. Because data bandwidth and disk space requirements are very small for this service, it does not make much sense to host this on a separate dedicated hosting service
5. A large number of developers with Google accounts can work on the same instance, if there is a need to iterate over it in future

5. EVALUATION

Edumate may be easily regarded as one of the many ambitious attempts to build a technology to support production of participatory video, without any strong adoption strategy or plan for gaining critical mass. However, that is not true given the clear focus on evaluation of the success of the project and aggressive attempt to target challenges identified at an early stage. Also, the likelihood of such adoption can be improved by a systematic process to incorporate valid suggestions and feedback from target users.
The metrics to evaluate the success of the project will include:

- Ratio of number of video contributions to number of active users viewing content
- Learning effectiveness of a sample video collection in classroom settings vs. same content taught by teachers in classrooms
- Trends in application installation and usage
- Rate of adoption in urban regions of developing nations vs. developed countries (during pilot deployment)
- Interest from national and international curriculum development bodies and education boards in prospects of application/project

6. FUTURE PROSPECTS

6.1 Possibilities with Peripheral Hardware

An interesting possibility discussed when this project was proposed was to bundle into the current system a peripheral device to allow educators to project/display the shared video content from the Android device onto different kinds of screens. Figure 3 depicts this pervasive scenario wherein the Android device relays the video signal over a wireless protocol (possibly 802.11n) to the peripheral device, which then connects to a television or an LCD projector through a RCA/VGA/HDMI signal output. The purpose was to integrate this application into classrooms to allow administrators/teachers to seamlessly share video content with students or teachers (under training).

![Figure 3. Scenario using a peripheral device to connect to a display screen](image)

7. CONCLUSION

*Edumate* presents an interesting opportunity to allow participatory video content creation not only in the space of K-12 school education, but also outside the school context. It may be adopted by organizations for internal knowledge management. Other privately funded educational video learning programs may be run on this infrastructure. The opportunities here are many, and the simplification of the process finally makes it possible for contributors to upload content in very less time.

Also, this paper only discusses the possibility of using the application for teachers to upload content for other teachers or students. There are many possibilities here: curriculum creators produce content for school teachers, administration officers, students, etc. Students may find it far easier to record themselves offering explanation of concepts from their mobile phones, and upload it so that their fellow students can watch these either on YouTube, on a website displaying the YouTube channels feeds or on their own smart phone devices.

Another interesting possibility lies in extending the application to support content creators to upload documents and presentations, apart from just video clips, support instruction and learning. This would require drastic changes in the architecture of the application, because of the current dependence on YouTube, but it might really enrich the application.

8. APPENDIX A

(this is by no means a comprehensive and/or accurate list of reasons)

1. Educational authorities, such as national education councils and textbook publishing houses, are not proactive in ensuring production and distribution of digital content or platforms
2. Most schools in cities and towns in developing countries (not rural regions) are unable to employ additional resources to built IT infrastructures (hardware, software, support, networks, administration, etc.) due to budget constraints and evaluation & human resource recruitment hassles, to support access to such content
3. Teachers haven't been trained to deliver lectures in classrooms using digital display devices, computers or other devices. Traditional education pedagogy revolves around textbooks, blackboards and teachers standing in front of large classes speaking, with no supporting print or screen displays. There is a big learning gap here needed to be bridged
4. Educators are often exposed to abundance of information on the Internet, and lack the skills to manage this exposure to information and streamline this content to deliver effectively in classrooms

9. REFERENCES