M-Learning Using Cloud Computing

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In the past five years, the prevalence of cloud computing or cloud storage has escalated with the advent of services and companies such as Google Drive or Dropbox. The attention of the computing community is now more geared to exploiting the advantages associated with the use of cloud computing and rectifying any of its disadvantages such as security, energy, and memory. With the increased use of cloud computing comes new possibilities for uses that can make already available content more accessible to various types of user audiences. In particular, cloud computing has been essential in the development and increased used of mobile learning, or m-learning, technology. Through a literature review, this paper will justify the need for and importance of mobile learning technology, evaluate how cloud computing addresses concerns of mobile learning technology, investigate the projects that have attempted to incorporate these two different concepts, and also consider the future steps that are necessary in order to execute the I Want To Know or iW2K search engine for mobile devices.

Literature Review

The first two papers by Hwang, Change, Toteha, and Kumar evaluate why attention needs to be on mobile learning. Mobile learning, as defined by Holzinger et al., is a combination of mobile computing and devices with e-learning. In the study on formative assessment-based mobile learning conducted by Hwang and Chang, the applicability of one learning technique was tested on mobile devices. This study included an experiment for elementary children incorporating the use of mobile devices through a historical site visit. The experiment was particularly strong due the fact it had both a

control and experimental group and also utilized pre- and post- tests. The experimental group utilized the formative assessment-based mobile learning technique which involved hints from the mobile learning environment encouraging them to find the correct answers to failed questions on their owns. Their counterparts who were given the answers to the failed questions with extra materials for them to review. This study showed that those utilizing the formative assessment learned more than the control group, which is in agreement with studies completed on the same technique of learning on web-based devices. As a result, it can be said that other learning techniques found successful for web-based use could be translated for use on mobile devices and be just as successful.

The next study, completed by Dr. Ravi Toteha and Dr. Sarita Kumar, had university students complete a survey on their mobile devices and how they used them. Although this survey has numerous flaws that makes it reputability questionable, it still provides insight into how this subset of people use mobile devices. It also highlights how there is a need to study and explore for the extent of the capabilities and impact of mobile learning. Other than these few revelations, the survey results also supports the unsurprising advantages of mobile learning like ease of access, less time restraints, improved communication and independence of users. With both of these studies in mind, it is clear to see that there are various aspects of mobile devices and learning that can still be explored. There are evident advantages to the use of mobile learning and there are even more advantages and even disadvantages left to explore. For the purpose of the For Youth, For Life (FYFL) network, the focus will be on the advantages of the relationship between mobile learning and cloud computing.

Both mobile learning and cloud computing are fairly new advances that have benefits that can make a difference in the field of computing and also in education. Cloud computing is a solution to the key disadvantage of mobile learning which is the lack of storage space available on a mobile device. Cloud computing also provides other benefits and opportunities that could streamline the abilities of mobile learning programs.

"Cloud Computing Through Mobile Learning" written by Rao and Kumar summarized the impact of cloud computing thoroughly by stating it "will soon become a disruptive force in the mobile world" and will be a pivotal part of how mobile applications are designed and operated. This paper also referenced a survey completed in October 2010 and designed by the authors. Although it does show that 94% of the survey takers believed that such technology could help bring down the cost of quality education. It did not, however, provide any more details of the survey. There is no mention of how many survey takers, how it was distributred or any other information that could make the survey results and the entire paper stronger. The survey also provides helpful info on the survey takers awareness of the technology. The main purpose of the paper was to compare the Client and Cloud Model Infrastructure and propose new models that integrated in mobile-learning. According to this paper, cloud computing would be responsible for data sharing security and load management, and increased storage space which would make mobile learning more efficient in time and storage space. With the fact low cost of cloud usage through companies, this allows for inexpensive use of cloud computing technology that would also make mobile learning inexpensive and accessible.

The particular strength of this next paper by Jian Li was its overview of the various models that can be done in mobile learning. With this paper, it is more clear

what the technical model of the IW2K model should be. According to this paper, the real-time online model is most appropriate. This model is defined as a model that stores resources on a server which can be accessed via wireless networks allowing for real time interaction. The weakness of this model is that it has to depend on wireless networks. It is also clear according to this paper that the IW2K model is also asynchronous since learning and teaching is not occuring at the same time. One of their proposed models is the autonomous mobile learning model which occurs in the environment of cloud computing. This models requires that there is a search for learning resources, similar to asking the IW2K interface a question. However, this model is also to aid the completion of tasks related to learning objectives set forth by the learner. To my knowledge the IW2K model does not yet consider such tasks or objectives.

With a better understanding of the relationship between mobile learning and cloud computing and various models involving the two, we can now evaluate what projects have actually used cloud computing for mobile learning purpose and how. It apears that after searching, there are not many projects that have published work that actually combined both entities besides one article by Branon, Wolfenstein and Raasch publiched last year. This article provides valuable insight to into how an educational app for review of Advanced Placement material was created and made available on the iPhone iOS. The most important is how the material was organized and prepared to be stored in the cloud through the Amazon database. "The Amazon Simple DB "item attribute" was used to store the content elements. Item attributes, however, are limited in size to only 1024 bytes. Some questions contained more than 1024 bytes of information. The solution required a workaround of breaking each question into a chunk no bigger than 1024 bytes.

An additional attribute was added to identify each question part so they could be reassembled when downloaded to the iPhone application breaking a question into chunks based on size rather than component parts of the question (i.e. stem, answers, feedback), made reassembly far easier for the iPhone app." It lacks, however, mentioning their other options in databases. It did bring some questions to mind including what are relational databases, how to set up the IW2K interface with in-app purchasing, and how to utilize and bring in videos, images, and links. This paper provides good insight to how we can go about developing the iW2K. The next portion of this literature review will be to evaluate studies that could be useful in what steps should be taken when developing the iW2K application and continued work on the FYFL network. However, these studies in particular do not exactly combine the use of cloud computing and mobile learning but can still be helpful in other manners.

The first study, completed by Ardito, Buono, Costabile, Lanzilotti and Piccinno, provides details on how to design for mobile devices when particularly used in the field exploring culture and history. The biggest takeaway from this study was their decision to involve the users in every step of the process of developing the device. Since I am becoming involved in the FYFL and iW2K projects in the middle of the development, I am not entirely aware of what all steps may or may not have been taken in my absence which raises a lot of questions in terms of if the end users are at all involved in the design process. This paper also raises questions about how the devices are evaluated and the conditions and environments in which they are used. How will we evaluate the effectiveness of the iW2K application and FYFL network? There has been mention of using the number of hits or accesses to a specific topic or page and also possibly how

many downloads of the application there are. These options should be considered as well as others. This paper provides a starting backbone for the beginning design and what questions we should posit in preparation for development.

After reviewing these 6 papers, it is clear that the resulting technology and advancements when combining mobile learning and cloud computing is an area in the field of computing that has not been fully explored. Because of this, our work with the FYFL network and iW2K could really set the tone for future work in these two areas. The papers involved studies and projects that do not have the same goals and purposes as the iW2K project. The next step in this endeavor is to develop and understand the requirements for the application, develop accomplishable tasks and stepping blocks.

Design Implementations

FYFL Architecture

In order to better understand how iW2K could be implemented it was imperative that the architecture of the current FYFL Youth website through Extension be evaluated. Myself and two other research students first evaluated the efficiency and content of the website in its then current state. After an evaluation, we learned more about the content management system for the entire site and learned how to gain access and make changes to the specific site in question: FYFL Youth.

It was discussed that interactive and interesting content for middle school age students, their parents, and/or teachers was desirable. Items like videos, projects, lesson plans, and games related to the 4H preferred curriculum and content was then found through online searches and formatted for the website. Throughout this process, tagging

was done to link related topics together. For instance, content under the category of "All About Water" listed on the website might have tags or links to the hydroelectricity portion of the "All About Energy" site.

There was little that could be done to address organization and transition on the website since the FYFL Youth site was a part of the much larger and national Extension website. As a result we were restricted to certain aspects of the features in the website like headings, menus, and more. Since then the entire website has been redesigned; however, the content found has yet to be utilized.

4-H Badging System

The 4-H badging system refers to the ability of 4-H students, youth and adults, to log into a website with credentials, perform activities specified for certain categories (i.e. robots), complete a questionnaire and obtain a badge in their virtual backpacks to signify their accomplishments. This project does not directly link to the FYFL Youth website; however, there is the potential of the badging system being available through mobile devices. Such a feature could possibly require the use of a cloud.

There are three different prototypes of the site implemented in different ways. The first prototype is implemented solely through Drupal, the second PHP, and the third Apache-MySQL-PHP (AMP). The project first started with understanding the different approaches and reviewing the thousands of lines of code created by the Master's student over the project. After that, there was need to further develop the Drupal version of the site into a fully functional website that included a user registration system that could handle the specifications of handling four different user groups. These groups included

youth between the ages of 13 and 16, youth between the ages of 16 and 18, adults, and 4H administration on the local, state, and national levels.

CS 10K Finite State Machine

Although seemingly unrelated, this next project was actually aided by my knowledge on the FYFL website and badging system. This project was approached as if it would be an item potentially to be featured in the FYFL extension site or utilized as a requirement for the 4-H badging system. This project entailed devising a game that could translate a CS principle to be taught in computer science high school courses. In this case, the principle was Finite State Machines. The premise of the game is to choose a level and then a game board that would present a story or steps in a system. The user is expected to identify all of the current and previous states, inputs, and outputs in a table format. The game is in a primitive stage and has not be evaluated. The game heavily relies on the users spelling and location of their answer into the table for correctness. For example, the input may be in the right column but not in the right row although it and all of the other responses match accordingly.

Future Work

The FYFL Youth website updates will continue with the intention of finding content interactive, interesting, and easy to find for students, parents, and teachers. The success of the update and the website will be evaluated through website analytics such as number of visits each page of the site obtains and the bounce rate.

The 4H badging system sites will be evaluated and compared based on their interface, design, and other characteristics through a study of 4H participants using the system.

The Finite State Machine game has potential to grow into a more robust and dynamic game that could be included in the FYFL website or the high school computer science curriculum or shared via the internet. The game will require extensive updates such as ensuring that the correction of the responses are the primary responsibility of the game rather than the user which includes accepting answers despite their order and making the game less dependent or correct spelling.

Through the continued work on these projects, the idea of a mobile I Want To Know app, and possibly more features, is closer to coming to fruition. These projects will provide insight on what would be the best approach to implementing the program and making it a widely used application expanding the basis of mobile learning and cloud computing.

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