

Mobile Learning in the Cloud: New Stage for Knowledge Management

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Abstract— In the era of globalization with increased mobility, the learning process is becoming more and more ubiquitous. To satisfy the growing industry requirements and also to enhance the educational growth, it becomes necessary to incorporate new and innovative technologies in to the educational system. Hence to improve the learning system, Mobile learning has been implemented by many colleges and universities. In addition Cloud computing technology has become popular that can reduce the storage cost incurred in Mobile learning. This model of Mobile learning in the Cloud has a number of advantages and has now become a new stage for Knowledge Management in the educational institutions. This paper presents a discussion on how a Knowledge Management system is implemented using Mobile learning in the Cloud with the associated merits and demerits.

Keywords— Cloud Computing, Mobile Cloud Computing, Mobile Learning, Knowledge Management

I. INTRODUCTION

The coming years are expected to be a transition time for the education sector. Two technological areas are expected to show a lot of growths in the education sector are cloud computing services for education and mobile learning [1]. These two areas are also expected to join together into a new field of enormous capabilities called Mobile Cloud Computing, as cloud computing solutions can be enhanced to provide greater capabilities in the mobile platforms related to information access and communication.

Today, the existing education system is considered as unsuitable both for the educational growth and industry requirements. Hence it becomes necessary to modify the existing education system according to the needs of the industry and society. Mobile learning is the latest concept used in the education sector; the intension is to enhance the education system with the latest technology.

Mobile learning is a mobile phone based learning system, to support, manage and enhance learning [2]. Its use is not intended to replace the present education system; however it aims to improvise it. Mobile learning has got many advantages like flexibility, scalability, openness and so on; it will transform a new system of education in the new century.

Mobile Learning is also considered as a complementary approach to implement Knowledge Management in an organization. Knowledge management is the method of managing, organizing and distributing the knowledge represented by documents, manuals, video and audio by means of effectively managing the people, internet and

mobile networks [3]. Thus, Mobile Learning is a part of knowledge management which facilitates learning as a major part of distributing knowledge.

In the existing learning systems using internet, the system construction, infrastructure and maintenance are to be performed within the organization. This requires a lot of investment and results in a lot of maintenance overhead. Hence, the institutions are required to find new techniques which provide better and economical services for learning.

Mobile Cloud Computing has become a hot research topic among companies and researchers, as it offers convenience, ease of use and other advantages [4]. It has changed the view of internet into a new computing paradigm, having a broad development prospectus. The application area of Mobile Cloud Computing has extended in almost any area including education sector.

In contrast, Mobile cloud based learning system offers several advantages. On the one hand, the Mobile cloud developers can use their own technological skills to build a learning system having good performance, many functions, and a large number of features. On the other hand, institutions are free from building and maintaining the learning system; they can focus on using the learning system in a better manner in order to improve the education quality.

This paper starts with discussing Mobile Cloud Computing, its benefits and issues. The section 3 discusses Mobile learning and related issues. Section 4 deals with issues involved in implementing Mobile learning using Mobile Cloud. Section 5 discusses the implementation of Mobile learning to support Knowledge management in the Mobile Cloud.

II. MOBILE CLOUD

Today, the Smart phones are growing at rapid phase which are equipped with a large number of features and applications. They have the facility of moving anywhere and accessing the data any time. With the ability to access the web any time, the Smart phones can be connected to cloud emerging a new computing paradigm called Mobile Cloud Computing.

The Mobile Cloud Computing Forum defines Mobile Cloud as follows [5]: Mobile cloud computing is a system in which both the data processing and data storage are performed outside the mobile equipment. It performs the computations and storage of data in the cloud and out of the mobile, bringing applications to not just sophisticated mobile users but a wide broader range of mobile users.

In spite of many barriers and challenges, the Mobile Cloud Computing has gained popularity and being widely used by the users all over the world. Today Mobile Cloud is being used in a variety of applications as discussed in [6]. Common applications of Mobile Cloud include:

- Email: It is the primary and important application of Mobile Cloud. Here the emails of users are stored on a mail server which resides outside the mobile device. Users check their mails using their mobile devices, which is a live example of Mobile Cloud application.
- Mobile Commerce: Mobile Commerce (M-Commerce) is performing different transactions using mobile devices. M-Commerce applications include Shopping using the mobiles, Ticket reservation using mobiles, Payments made using mobiles, Messaging and Advertising.
- Mobile Healthcare: Mobile Healthcare (M-Health) is the concept of using mobile devices in the healthcare sector. The main reason for using Mobile in healthcare is to provide better service to the patients and enhance medical treatment. Accessing patient records easily and quickly is an important example of M-Health. One example application is provided by the authors of [7].
- Mobile Gaming: Mobile Gaming is the idea of playing games on the mobile devices. Usually playing games requires many computing resources like sophisticated graphic displays. With Mobile Cloud all the computations are performed outside the mobile device and in the cloud. Hence Mobile gaming application is an important application of Mobile Cloud which allows users to play advanced type of games on their mobile devices.
- Mobile Learning: Mobile Learning (M-Learning) is the concept of learning anything, anywhere using the mobile devices. It is the combination of concepts like Mobile Computing and E-Learning. The use of Mobile Cloud for M-Learning enhances advanced learning for the learners since all data storage and data processing are done in the cloud outside the mobile device. Hence learners get the service at a faster rate and at low cost.

III. MOBILE LEARNING

Mobile Learning enables personalized learning anywhere and anytime using any mobile device. It facilitates collaboration and communication among participant learners in an efficient manner. Mobile Learning has the ability to extend learning outside the classrooms.

According to [8], Mobile Learning can be defined as any sort of learning system, in which the learner need not be at a fixed, predetermined location or learning that happens when the learner utilizes the advantage of the learning offered by mobile devices.

The advent of sophisticated and advanced mobile devices opens up the possibility of learning outside the classrooms as well. Mobile devices can be used for communicating, collaborating and sharing the knowledge among the students even after the class hours. Such informal type of learning has been discussed in [9].

During the last decade, a lot of Mobile Learning projects were carried out. In [10], the authors have identified more than hundred of such projects. They concluded that Mobile learning provides the aid for learning rather than providing content for the learners.

In spite of all these developments in Mobile Learning area, still it lacks the firm guidelines in order to implement Mobile Learning. Presently the Advanced Distributed Learning (ADL) [11] is developing a project to support best practice guidelines for better Mobile Learning design.

Like any other growing new technology, Mobile Learning has also its own advantages and disadvantages as discussed in [12] and [13]. The advantages of Mobile Learning are:

- Learning can happen anytime and in anyplace.
- Learning can happen even after class hours.
- Students and tutors can continue the learning process even while moving.
- Review of learning content can be done when needed.
- Instructors can focus on weak students to enhance their learning process.

The disadvantages of Mobile Learning include:

- Due to network connection problems teachers and learners may not be connected always.
- It may require an additional tutorial on how to use the technology itself.
- Mobile application usage may not be convenient for the non-technical stream of students.
- Mobile learning may provide the students an opportunity to cheat, if there is no monitoring system.
- It lacks physical interaction between the student and the teacher, which is so called ideal situation of learning.

IV. MOBILE LEARNING IN THE CLOUD

It should include important findings discussed briefly. Mobile Learning was on the move in the last decade and efforts have been put to enhance its performance. Basically

implementation of Mobile Learning requires a lot of investments and resources. Hence to popularize Mobile Learning some alternatives were required to be implemented in order to reduce the investments. The Mobile Cloud Computing is found to be the best fit technology for the same.

In Mobile Cloud Computing, hardware resources and storage are provided outside the mobile device. Thus Mobile Cloud based M-Learning eliminates device resource and storage limitations. Also Mobile Cloud significantly reduces the investments to be made to implement M-Learning.

In [14], the author has thought about introduction of Cloud computing in the education sector and discussed about the possible benefits and drawbacks.

In [15], the authors have coined the idea of an E-Learning ecosystem based on Cloud. They analyzed the usage of various public cloud platforms in e-learning and also listed the associated benefits.

The authors of [16] have developed an E-Learning system based on Cloud Computing and studied the positive impacts of the same.

An E-Learning architecture based on Cloud Computing was developed by the authors of [17]. Based on the new architecture E-Learning system was successfully implemented using the Cloud and performance of the new system was evaluated.

Based on the research on E-Learning and Cloud combinations, the idea of M-Learning and Mobile Cloud combinations have evolved. The authors of [18] have used the concept of Cloud in the implementation of M-Learning and studied the benefits of using Cloud in the knowledge acquisition process.

In [19], the authors have formulated the architecture of M-Learning system using Cloud. The analysis of such an M-Learning architecture has also been done.

The authors of [20] have discussed a number of issues in the implementation of Mobile Learning using the Mobile Cloud. The benefits of using Mobile Cloud in the implementation of Mobile Learning have also been discussed. The advantages of M-Learning using Mobile Cloud are:

- **Reduced cost:** Some cloud providers offer free applications for the implementation of Mobile Learning. This results in reduced investment. Hardware and software costs will also be reduced, since the need of Laptops are eliminated and storage space requirements are reduced by the use of cloud.
- **Versatility:** There are a large number of applications are available that facilitate Mobile Learning. The users can choose among these applications according to their requirements.
- **Improved software compatibility:** Different users can use different versions of software. The compatibility issues will be handled by the cloud.

- **Improved performance:** Since Mobile device uses the cloud, less memory is used and fewer programs need to be installed results in better performance.
- **Improved reliability:** Since the data resides in the cloud, the problems associated with data loss are reduced.
- **Device independence:** The use of cloud eliminates the restriction of the usage of a specific type of hardware device and different types of mobile devices can be used.

At the same time, the implementation of Mobile Learning using the Mobile Cloud poses several issues and challenges. The issues and challenges as discussed in [21] are:

- **Privacy:** Since data of the user resides in the cloud storage, it results in data privacy problems. The private data will be exposed due to the cloud [22].
- **Compliance:** Most of the data compliance laws and regulations assume that the data resides with the user. But while using the Mobile cloud, data will be stored in the cloud storage itself. This results in compliance issues.
- **Interoperability:** When using the Mobile Cloud, the users may use a variety of mobile devices. Developing applications to suit all these devices is a challenging task for the developers.
- **Data Integrity:** The data of the user residing in the Mobile Cloud is accessible for anyone. There is no difference between ordinary data and important sensitive data in the cloud.
- **Security:** The use of mobile devices for accessing the cloud poses several security challenges including Virus, Malwares, and Trojan horses [23]. Another security issue arises related to user privacy when user uses the Global Positioning System, which exposes his present location.

V. MOBILE KNOWLEDGE MANAGEMENT SYSTEM

In the recent past, M-learning [24] and Knowledge Management systems [25] have proved their usefulness in the knowledge sharing processes. The mobile approach facilitates the delivery of learning materials in place and time which was out of reach before. Though, there two technologies use different terms and developing independently essentially they are about the same i.e. learning and knowledge acquisition in a mobile platform.

The system will be used for creating, updating, sharing and overall Knowledge Management in an institution. The proposed system includes two subsystems, one is the cloud server that is used to store the documents uploaded by the teachers and the other one is the client mobile. The client will connect to the server in order to access the learning materials. The server will authenticate the user and only valid user is allowed to access the materials.

In order to implement M-Learning in the cloud, an Android application called MobileKMS was developed and installed at the client side. Using this application the client is able to connect to the cloud server, which is a local server installed on a desktop system.

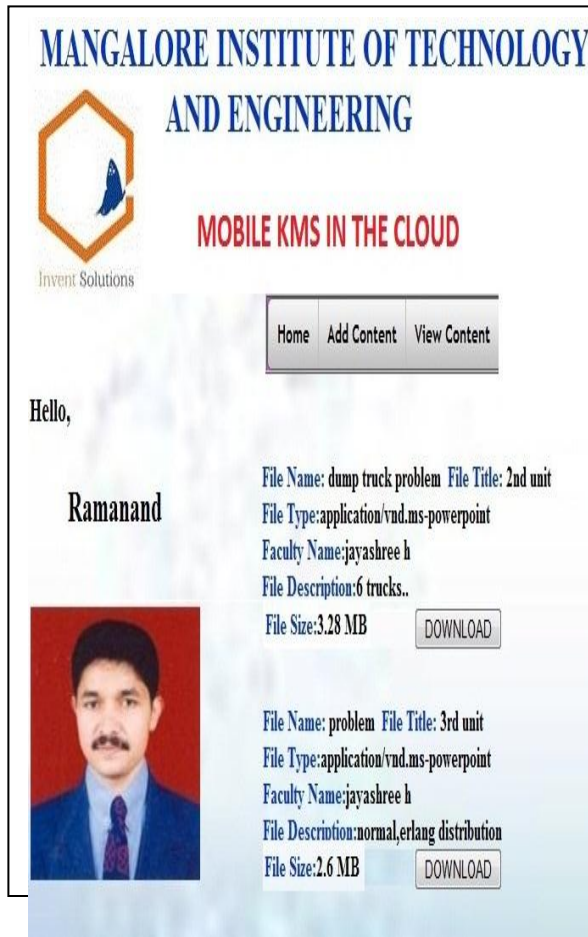


Fig. 1. Mobile KMS Application

MobileKMS is basically designed to provide a self learning environment. In any Educational organization, the teacher takes the class and student must be there in the class. Instead of giving lecture in a class, the staff can upload the specific study material to this system, where a student can view it on the system and he can download it if it necessary.

Thus a Knowledge Management System is developed in the Mobile Cloud for the benefit of students. It is evident that Knowledge Management System is an efficient alternate method to implement Mobile Learning.

VI. CONCLUSIONS

Mobile Cloud Computing is one of the latest trends in the information technology sector, which is still a developing paradigm. Definitely, the technology will undergo numerous changes in the future, in terms of security issues, best policies

and standards. Implementing Mobile Learning using the Mobile Cloud is also a relatively new innovation, which definitely has a number of advantages compared to the traditional learning process. At the same time learning in the Mobile Cloud has to face a number of issues mainly related to security of user data, which has to be addressed. There is a lot of scope in the research in this field where a number of security measures and algorithms can be developed in order to develop an efficient Mobile Learning using the Mobile Cloud. We have developed a system that supports Knowledge Management using Mobile Learning in the Cloud. Our future research plan would be to develop different methods and algorithms to enhance security in the Mobile learning system within the educational cloud.

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