Executive Summary

Information and Communication Technologies (ICTs) continue to drive the momentum towards enormous change and developments in academic community. It is an undisputed fact that the proliferation of ICT tools and the innovations of internet technologies have completely revolutionized the way in which we access, collect, organize, and search multitude of different information resources in multiple formats. In such a situation the role of academic libraries has been indispensable in the promotion of excellence in teaching and learning especially in the networked academic learning environment.

The growth of telecommunication medium is one among the support systems of ICT which has seen a sea change in the past several years. This growth is ascribed to the desire for users to use technology anywhere and anytime especially while they are on the go. A number of users prefer to use different communication mediums to access internet and mobile phones seems to be one of the primary source to access internet. The proliferation of mobile technology especially the 3G hype and the subsequent Wi-Fi innovations have triggered an unprecedented change in the access tools to internet.

With the advent of mobile technology as a prime technology within ICT and the fact that educational institutions use ICT as the main component to advance the cause of teaching and learning, the entire concept of learning has been redefined. This has led to a fascinating growth in the user base for mobile learning. Mobile phones have become an inseparable part of everyday life for academicians. Many studies show the relative growth of mobile usage among students of higher learning and their desire to use mobile technology as their primary access technology.
The changing environment within the academic institution, especially after the advent of mobile technology, has also greatly influenced the imminent changes in library services. Mobile learning enabled the convergence of teachers, students, classrooms, textbooks and information sources through a single mode of access and the libraries are looked up as the perfect place to connect all these different elements of learning. This has left academic libraries with very interesting dilemma in providing on-demand, perpetual mobile interface to their existing services. The demand for mobile based access to information resources have escalated to such an extent that the libraries are left with no other choice than to take the mobile route.

In reality the sad truth in libraries is that, while the innovations of mobile technology have captured the imagination of e-commerce and the entire learning eco-system, it has not dramatically caught-up with the libraries. It’s worth observing that libraries are just starting to make their first step into the world of mobile learning, especially providing basic access to library resources through mobile phones. In the mobile application market place the libraries have not started making any significant inroads at all. Out of the hundreds of thousands of mobile applications available for mobile phones, the amount of apps that librarians have built for libraries can be counted on one hand!

Theoretically while all the operations in the library can be transferred into mobile based applications, the ignition needed to spark that revolution is still missing. There is no doubt that the libraries are slowly moving towards offering mobile based applications but the concentration seems to be on providing some specific or isolated aspect of the library service as mobile application. The focus of libraries with regards to mobile technology seems to be centered around the ready reference queries or circulation related activities.
The broader picture which emerge out of literature reviewsand situation analysis is that there is no doubt there are experiments done on the use of mobile technology on different aspects of library activities but most of the applications or mobile activities for libraries tend to address a single or an isolated activity of the library. **This study was aimed to answer the lacuna which exist in the mobile integration of library services, especially library services as a whole package.**

The main objective of this study is to investigate ways to integrate all the different library mobile activities which are being practiced in isolation into a single framework. While attempting on such a framework it is imperative to analyse the library activities as a whole and see the areas which can be integrated through mobile technology. So the research question that arose out of this exercise it to find out how all the different mobile applications which are practiced as isolated applications can be integrated into a single framework whereby it can be amalgamated into the library mainstream. The byproduct of such an effort is the enhanced and streamlined mobile integration of all the activities as one single application.

While attempting a research on mobile integration of library services the following general questions were formed as the basis for the research:

(a) Which library activities can be incorporated into mobile technology?

(b) What are the available mobile integration methods for different library activities?

(c) What are the anticipated developments in the mobile integrations?

(d) What is the future of libraries with reference to mobile applications?
How to integrate all the different operations into a unified application?

The main objectives of the study can be summarized as:

1. To analyse and determine which library activities that can be integrated through mobile technology

2. To create a flow diagram for each of these activities mobile integration.

3. To examine the available mobile applications and interfaces for libraries and determine their use, specification and shortcomings.

4. Formulate an integrated mobile application with a complete flow diagram which can incorporate all the different activities of library as a single mobile application.

In order to achieve the desired result an experimental methodology was used. Since the research involved in creating a mobile application which has a computer and mobile phone output an exhaustive coding and testing of each component of the library activity was initiated. Codes were developed in C++, JAVA, HTML5 and PHP and loaded on to a server with sample data to test its running. In order to ascertain the flow of program and to satisfy the user preferences surveys on vital decision making situations were conducted. Before an attempt was made in writing a program, standards for each and every mobile related library activity was analyzed and documented and work flow diagrams for each activity was formulated and documented.

The outcome of this exercise is this thesis. This thesis is organized into seven chapters. The first chapter provides general introduction to the research with an introduction to ICT and mobile communication systems. An exhaustive literature review is provided in
this chapter on the given topic to substantiate the research questions. The methodology, scope and the objectives of the research are also discussed in this chapter.

The second chapter is dedicated to the mobile telecommunication systems with an overview of its genesis, current trends in mobile technology, mobile network standards and finally touch on the relevance of mobile technology to libraries and how it will be used in the research. A section on Terms and Concepts which are dealt in the chapter and which are relevant to the mobile technology as well as mobile computing are also elaborately dealt in this chapter.

Chapter three introduces the first aspect of mobile interface for libraries by looking at the Library Website interfaces using mobile technology. This chapter looks at the standards to create mobile ready websites, software to make mobile ready websites, testing standards and will as a practical approach a prototype of mobile library website is also dealt.

Chapter four deals with the library Online Public Access Catalogues using mobile technology. This chapter looks at standalone mobile catalogues, integrated mobile catalogues, mobile catalogue standards and mobile library catalogue prototype.

Chapter Five look at various Electronic Resources which are commonly found in libraries that can be integrated using mobile technology. Special emphasis is given to the integration of E-books, E-Journals and E-Reference. This chapter also gives more importance to ready reference resources which can be integrated using mobile technology. This chapter also looks at all the electronic resource standards available and the best suited standards for mobile integration.
Chapter Six looks at Short Message Service (SMS) and integrating them to the library services. This chapter provides an overview of SMS technology along with SMS and library services literature review, possible library services through SMS, integration of SMS services in library systems and prototypes of SMS based library systems. Importance is given to SMS based Reference services also.

The last chapter, chapter seven, provides the results and discussions where a practical framework for integrated mobile application for library has been developed and discussed in detail and this chapter summarizes the research with concluding remarks.

The final results of the research is the creation of flow diagrams for mobile integration of each and every major activities of the library and finally an integrated framework with an integrated flow diagram and output of a mobile library program. The Following four prototype application interfaces along with flow diagrams are derived from the discussion. They are:

1. Mobile website prototype and flow diagram along with sample source codes.
2. Mobile Online Public Access Catalogues prototype along with flow diagram,
3. Electronic Resource integration through mobile interface with a separate application for Mobile Reference sources along with flow diagram and
4. SMS interface for library activities along with three flow diagrams and prototypes.
Finally an integrated application model with a complete flow diagram and the presentation of the integrated application has been provided.

With most of the documentations and scholarly articles specifically literature written on mobile applications for libraries are scattered and doesn’t cover library as a complete entity this study becomes significant as this will be used as a reference source for any library which wants to integrate its one or many of its activities using mobile technology. Since each activity in the library has been covered as separate chapters and in the end the integrated framework has been done through a complete program it will be useful for both an integrated solution as well as for a single activity. The flow diagrams will help library practitioners to systematically approach mobile applications for their libraries.

Keeping the enormous work involved in the planning and programing of the integration of all the library services in mind, this thesis has not attempted in integrating the management and decision making backbone work of the library through mobile interface. Library support and administrative interfaces like mobile circulation control, mobile acquisition control, and mobile electronic resource administration are not attempted. With the existing powerful desktop integration of such activities has been flawless and to attempt such a framework will need different set of standards which can be considered as the scope for further research at the later stage.

The future generation of library users are keen to use the innovative service delivery modes of libraries to drive their information quest and the library professionals are left with no other choice than to provide the next generation services to the library users. Since mobile technology is an upcoming technology for library services this thesis is a
step towards harmonizing such an effort with the hope that anyone who would like to provide such a service will use this as a guiding document to achieve that goal.