A Textbook of Research Papers

4G & 5G Technologies and its Applications on Online Learning and Banking

KRISHNA PRASAD K

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On

4G & 5G Technologies and its Applications on Online Learning and Banking

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Dedicated to

My Family & My Teachers

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PREFACE

4G is a fourth-generation wireless mobile communication technology succeeding 3G and it should follow the standard specifications specified by International Telecommunication Unit (ITU) in International Mobile Telecommunications-Advanced (IMT-Advanced Standards) with two standards as Mobile WiMax and Long-Term Evolution (LTE) released first in the year of 2007 and 2009 respectively. As per specification of IMT-Advanced Standards, 4G offers speed of 100 megabits per second (Mbit/s) for high mobility communication such as communications from train or car, and 1Giga bits per second (Gbit/s) for low mobility communications such as pedestrians and stationary user.

The fifth generation mobile wireless technology aims to achieve higher capacity than current 4G/IMT-advanced standard in terms of mobile broadband users per area unit, higher speed more than 1Gbit/s and high capacity streaming video. With the help of 5G technology, a large population of the user can view and play high definition media continuously without any break, many hours in a day with the help of their mobile devices.

The advancement in information technology has resulted in explosive growth in banking technology like ATMs, internet banking, and mobile banking. Banks which emphasis more on existing customer satisfaction and in attracting new customer have implemented online banking and mobile technology to make banking more convenient, attractive and simple. Computerization, wireless network, ATMs, internet banking and mobile banking can connect any customer of any bank in any branch with a customer in any other bank regardless of time, location or physical boundaries. With the widespread of banking technology, public users or customers could create an account from their smartphone without actually visiting the branch. Online educations are gaining more scope due to the busy schedule of working groups and their interest to acquire knowledge in new fields. Working group people find difficult to get admission in top institutions for their interested course due to competition and lack of time flexibility. Regular full -time university affiliated courses become lack of interest for the working group due to outdated curriculum, lack of innovation in teaching, unchanged learning and evaluation environment and lack of industry-oriented advanced courses. Some institutions/universities provide short-term online courses for working people, which are liked by many working people due to its new evaluation and learning methods, advanced curriculum, and industry-oriented subjects.

This book contains research articles related to Mobile Wireless Communication Technologies 4G and 5G Technologies. This book also contains applications of 4G and 5G Technologies in Online Banking and Online Learning. These papers published already in peer-reviewed International Journals. This Book has written with an intention to get all papers together under one roof, which will benefit all the researchers of related areas.

ABOUT THE AUTHOR

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Mr. Krishna Prasad K. has published **31** research papers in referred international journals with more than 85 Google Scholar citations and Ranked **29** in Elsevier SSRN elibrary journal papers of last 12 months updated on 01 March 2018. He has also presented **18** papers in conferences, out of which **2** were International Conferences and remaining were National Conferences.

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CHAPTER-1

THE GROWTH OF 4G TECHNOLOGIES IN INDIA-CHALLENGES AND OPPORTUNITIES

ABSTRACT

The existence of 4G technologies is the indicator or valid proof of the rapid and massive growth of wireless communication technologies, which is propagated through 1G, 2G and 3G technology and 5G as an upcoming technology.4G networks are introduced with the main intention of customization of a flexible and ubiquitous service provision in the middle of 2012 based on digital broadband packet and all IP very high throughput speed of 100-300 Mbps in peak. The widespread growth of the 4G technology in India will be driven by set of new services which will be made useful for the customers such as accessing the internet and video anywhere, any time and in any places with global roaming and full-fledged support for all other multimedia applications. In India even though 4G technology is introduced early in the year 2014, it's still not widespread due to some of the challenges faced by the mobile or wireless communication service providers. In this paper 4G technology with respect to the Indian market are analyzed using advantages, benefits, constraints and disadvantages. The different challenges include backhaul, voice over LTE, Regulatory challenge, Ecosystem related challenges, return on investment, chipset compatibility. Wish this paper could play an active role in actual research on4G technology in India.

Keywords: LTE, 4G, ABCD Analysis, Backhaul, Ubiquitous

I.1 INTRODUCTION

The rapid growth of the telecommunication industry along with wireless technology and internet created a new wireless communication channel named as 4G or fourth generation technology with characteristics as customized or personalized services, interactive multimedia, IP telephony, interactive games, high definition mobile TV, high speed broadband internet. In a simple way 4G is successor of third generation (3G) mobile communication technology standard with higher capacity and performance. The International Mobile Telecommunications Advanced (IMT-Advanced) specifies 4G, in terms of different features as speed of 100 Mbit/s or more while travelling and 1 Gbit/s while stationary, channel bandwidths of 5-20MHz or sometimes even up to 40MHz, all-IP based packet switching network and able to switch over multiple heterogeneous networks simultaneously [1].

Initially the 4G technology commercially introduced two forms as Mobile WiMAX standard (in 2006 in South Korea) and Long Term Evolution (LTE) standard (in 2009 in Oslo, Norway). Mobile WiMax or LTE was not available to all continents with same year of its invention due to the different frequency bands [2]. In India BSNL first launched a 4G service through 4G WiMAX Broadband in Kochi Kerala in 2011. But even today 4G wireless services have not spread to some rural areas of India other than some major cities.

In this paper, we discuss the growth of 4G technology in India. Challenges and opportunities of 4G technology in India are studied using the ABCD model. This paper will become a tool for the actual research and development of 4G technology in India.

1.2 BACKGROUND

India will become a dominant market for 4G technology due to the development of telecommunication industry and increased population. One of the main obstacles for the future and growth of 4G technology in India is the reduced speed of the internet compared to the developed countries like USA. The introduction of 4G technologies in India is benefited to different sectors such as telecommunication, healthcare, education and entertainment. In India the increased use of smart phone users has positive impact on the popularity and growth of 4G technology. Network discovery, access technologies, network architectures, network conditions, charging and billing, large number of operators, security, congestion control are

the some of the research challenges that need to solve for the development and advancement of the 4G networks [3-4].

In India almost everyone ended up upgrading 2G to 3G network, due to the faster availability of services and without more difference in terms of cost. The up gradations from 2G to 3G network do not require a complete reworking of the architecture of the network system. But in case of 4G network, it becomes necessary, adopting a new equipment or handset in order to avail new services. This becomes costly for the Indian customers, is also one of the hindrance to the growth of the 4G technology. In 2G and 3G spectrum band is uniform across different countries where as 4G is offered in different countries with different frequency bands [2]. Unlike 3G, 4G does not offer voice based services through mobile networks, instead it offers voice over internet protocol (VoIP) and it's based on packet switching technology. In India not all the service providers have the option to provide seamless 2G, 3G and 4G services using same spectrum band. In India 4G services are limited to data only without voice services. Portability and file clearing process are the two biggest obstacles or barrier for 4G implementation and development in India.

The mobile telecommunication service provider's who develops 4G networks exclusively and greatly depends upon advanced technologies and higher speed in order to dominate over their counterparts [5-6]. 4G requires a data transfer rate at least 100 megabits per second when the user is moving at high speed and 1giga bits per second when the user are stationary or in a fixed position [7].

In this paper with special reference to Indian 4G markets, we realized that it's become very essential to know the challenges and opportunities involved in 4G for the development and growth of 4G technology trough the background study.

1.3 CHALLENGES OF 4G TECHNOLOGIES

Deployment and growth of 4G technology in India is not easy due to several challenges faced by the telecommunication industry or 4G service providers.

A. Security: The 4G, LTE should focus on security objectives and corresponding technologies [8]. Howard, Walker and Wright, of the British company Vodafone quote some security principles for 3G, which hold good, even for 4G Technology as adequately protect

information against misuse in different situation/users like while user generating or accessing information, worldwide interoperability and roaming between different operators, between user and provider. It should also ensure that the security features and mechanism can be extended and enhanced as and when required for advanced applications or services [6].

B. Backhaul: While using the 4G network maximum amount of data transfer takes place between sever and application due to the consumption of bandwidth hungry applications. In order to meet the advanced applications and user requirements operators need to upgrade their backhaul, or bandwidth capacity in exponential form.

C. Multiple Frequencies: One of the major challenges is 4G LTE network uses multiple frequency band or spectrum in different countries. Moreover, operators need to add more radios/ spectrum other than their 2G and 3G spectrum band, which will incur more cost and complexity.

D. Voice over LTE: LTE has the capacity to carry all types of voice, video and data traffic services. But in India most of the operators have given more emphasis for the deployment and development of only data traffic without proper voice and video services. Operators can provide voice over LTE service using three approaches, namely IMS based "one-voice" approach, Voice over LTE via Generic Access (VoLGA), and Circuit Switched Fallback (CSFB).

E. Price and Smart Phone: India is always priced sensitive market, due to these operators always introducing one or other new cost tariff plans for both data and voice. The price of the 4G network is more, is the one more challenge faced by the operators in India. Compared to the entire population of India only few customers have smart phones and in which all smart phones do not support LTE.

F. Quality of Service: In India the service providers or operators always struggled to provide quality of service, even though they do a lot of efforts due to the large and diverse need of the huge populations. Data coverage has a lot of inconsistency in the rural parts of the country. In 4G, service providers should satisfy the customer as LTE expected to consume heavy data content such as videos, games and stream content.

G. Application/content: With 4G, customers are more interested to watch online video while they are moving or traveling causes more consumption of online videos. As more and more

customer's uses HD videos, streaming of HD videos is going to put a huge stress on the LTE network for which operators or telecommunication industry needs to be prepared.

H. Chipset compatibility: LTE chipsets needs to be built based on eco-friendly is one of the barriers around selection of different technologies and in the improvement of chipset performance. While developing chipset vendors should focus on some key parameters like Support for multiple technical parameters, backward compatibility, and reducing power consumption and chip size.

I. Return on Investment (ROI): Migration from 3G technology to 4G LTE entails high capital investment for the service providers due to the high spectrum costs and upgrades in network infrastructure. The biggest risk, therefore for an operator is to justify the ROI and sustaining in the market, in LTE network deployment.

J. Widespread of LTE to rural: All the operators in India focusing their 4G services in some of the Metropolitan cities and urban towns. In order to improve the performance and to get a huge number of customers' operators should focus on deployment of 4G services even rural areas of India.

1.4 OPPORTUNITIES OF 4G TECHNOLOGIES

4G networks are designed to facilitate the development of different sectors like telecommunication, healthcare, education and entertainment to the existing 3G technologies in terms of quality, bandwidth and data and video transmission and accessing speeds [9]. Following are the different opportunities on 4G technologies.

A. Cost and affordability: When 4G communication technology and network coverage increases the competition between service providers also increases. This creates more demand and popularity in the market. 4G service cost can be reduced with the high demand and popularity of 4G technology [10]. 4G networks are designed in order to create an environment that supports embodied in speed, bandwidth, low cost, better network, efficiency, personalization and advanced access technologies. As the technology reaches more and more customers or public cost and affordability successfully reduces.

B. Personalization: The personalization requires an integration and organization of a user's preferences. 4G Technology adapts sensor network, user profile and databases in order implement personalization or customization of user requirements.

C. Advanced Access Technologies: 4G technology uses MIMO-OFDM (Multi in Multi out Orthogonal Frequency Division Multiplexing) to better distribute resources among available various clients [11-12].

D. Coverage and Availability: 4G signals with more than 800MHz super frequency can penetrate to any extent with walls and any object to ensure wider coverage. If the service provider deploys proper and advanced technologies it can be available ubiquitously without any barrier to time, place and locations [13].

E. M-learning Capability: Using the 4G network in m-learning model, students can login to their notebook through valid username and passwords and can get information in terms of different multimedia applications like plain text, pictures, audios and videos and at the same time authorized instructor can upload information or contents like homework, announcements, SMS and quizzes.

F. Improved Entertainment for an Individual: An individual can get the benefits of 4G technologies as watching video with HD quality, video calls with high quality and high quality gaming applications. Due to this more and more customers, start watching their hand set for different video purposes will increase the demand and market of smart phones.

G. Banking sectors gets benefited through mobile banking: By adopting 4G technology, banking services can reach to rural area customers with high security through their smart phones. So customers can able to access their banking services anywhere, anytime and anyplace.

H. Private and Public organization Performance Improvement: Private or public organization can improve their performance with the use of 4G technology by reducing their cost of travel, tracking the employees, instant update on all government projects implemented and by utilizing high quality of video conferencing.

1.5 ABCD ANALYSIS OF THE 4G TECHNOLOGY

The 4G technology are analyzed using Advantages, Benefits, Constraints and Disadvantages (ABCD) analysis by considering different issues, which includes security, bandwidth, multiple frequencies, voice over LTE, quality of service, application/content, chipset compatibility, return on investment (ROI), widespread of LTE to rural, cost, affordability, personalization, advanced access technologies, availability, m-learning capability, improved entertainment for an individual, mobile banking and private and public organization performance improvement [14] .

Advantages:

- Increased security helps to improve the customer trust over new technology, authentication. There will not be any altering or changes in data during transmission and user cannot deny not sending the message because only sender and receiver will have a unique pair of password or OTP.
- When bandwidth is increased more data can be transmitted between sender and receiver. The user will be satisfied because of high bandwidth while accessing the internet or HD videos. Quickly download a file over the internet, easy access internet or multimedia files and HD videos.
- Implementing standard global frequencies will reduce the cost of the service provider and in a single stream able to deploy 2G, 3G and 4G services.
- Voice over LTE will increase the capacity to carry all types of voice, video and data traffic services; due to this more and more customers are attracted to new technology.
- Quality of services will be improved with the adaptation of proper advanced technologies in terms of availability of audio, HD video, data services ubiquitously.
- Extremely high voice quality and HD video ubiquitously due content/application services.
- Services based on user habit, preferences and needs can be provided due to personalization or customization of services.
- 4G communication technology provides some intelligent networks like open distributed AD-HOC wireless network and software defined radio.
- Through 4G technology Learners can control their own learning time by portable mobile devices. Mobile learning is more helpful for someone who are no longer restricted to time, place and locations.

- Private and public organization can grow due to 4G technology by reducing their cost of travel, tracking the employees, instant update on all government projects implemented and by utilizing high quality of video conferencing.
- With the adaptation of 4G technology, banking institution can provide banking services to its customers in rural areas through mobile banking services.
- When 4G communication technology and network coverage increases the competition between service providers also increases. This creates more demand and popularity in the market.

Benefits

- 4G are very easy to install and maintain.
- Due to higher security, service provider or operators gets more profit and popularity and advancement of the new technology also improved.
- Global or national wide expansion of 4G services.
- The ability to obtain a larger customer base due to ubiquitous services.
- The ability to take advantage of the growing popularity of Smart Phone banking
- Enhances reputation of the operators by providing fast and secured services to its customer.
- Expansion of Smart Phone users.
- Banks can able to attract business people, software engineers or other tight scheduled customer pool due to their nature of professions for mobile banking services.
- High quality of services.

Constraints

- Lack of newer technology support.
- Possible failure of new technology due to non-acceptance of customer.
- General competitiveness of the service providers.
- Mandatory of smart phones or shifting of new equipments cost more for the customer reduces the 4G usage in India.
- Government policies will affect on usage of 4G services.
- Different frequencies are used for 4G services in different countries creates an extra burden for service providers.

Disadvantages

- New frequency requires added components in the service provider's tower.
- 4G does not offer voice services through mobile phone rather than it uses voice over internet protocol (VoIP). When the user logged on to 4G services will be transferred to 3G services, when the user receives a voice call.
- Voice over LTE (VoLTE) new services of VoIP in 4G technology, is not widespread or it's in infant stage.
- Portability and file clearing in 4G technology is a lengthy process, which is very costly, not affordable by ordinary customer.
- Requirement of high memory and processors at service provider's servers.
- Lack of technology support.
- Initial investment in technology will be expensive.
- Lack of trained staff.

1.6 CONCLUSION

4G wireless technologies provides a wide variety of services, which includes improved bandwidth, advanced personalization or customization, high speed HD video and multimedia services. With the deployment of 4G technology Indian Telecommunication industry and Information technology witnessed massive significant transformations. In this paper we have discussed the some of the challenges in terms of Security, Bandwidth, Multiple Frequencies, Voice over LTE, Price and Smart Phone, Quality of Service, Application/content, Chipset compatibility, Return on Investment (ROI), Widespread of LTE to rural area. We have also discussed opportunities of 4G technology in India in terms of Cost and affordability, Personalization, Advanced Access Technologies, Coverage and Availability, M-learning Capability, Improved Entertainment for an Individual, mobile banking, Private and Public organization Performance Improvement.

The 4G technology is analyzed using the ABCD model which explains the advantages, benefits, constraints and disadvantages of 4G technology with special reference to Indian market. A nationwide drive in the form of marketing campaign by the regulator or service provider will enhance the growth of 4G technology. The government should pass a standard regulation for the development of 4G technology. More emphasis should be given for wider coverage, voice call, increased bandwidth and speed for multimedia services. The operator should also give importance for customization and personalization of 4G services along with

the scalability issue for new usage patterns like social networking and peer to peer services. The Indian market will play a significant role in the future growth of 4G technology due to its population and a wide variety of customer requirements. Wish this paper could play an active role in actual research on 4G technology in India.

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CHAPTER-2

MOBILE SYSTEM FOR CUSTOMIZED AND UBIQUITOUS LEARNING BY 4G/5G

ABSTRACT

Mobile system effectively uses new mode of e-learning through smart mobile phones and wireless network with the ability of omnipresent learning. 4G/5G is introduced with the intension to provide customized and ubiquitous services in terms of faster communication, wider network spectrum and more flexible communications. In present traditional education system learners neither change the content of the curriculum or courses nor access latest information in customized form. The aim of this paper is to provide the Customized and Ubiquitous Knowledge to the learners through smart mobile phones. This paper mainly concentrates on video lecturing about multi disciplinary subjects through smart mobile phones, which uses the features of 4G/5G. The developed system is user-friendly and customized and can improve the electronic learning in a wide range. The system uses WiMax protocol and User profile, in order to access video lecturing and to know the requirements or user preferences multi disciplinary subjects respectively. This paper could play an active and supportive role for students, teachers and educational organization such as universities, schools and institutions which looks for proper m-learning system.

Keywords: 4G, 5G, WiMax, M-learning system, Ubiquitous

2.1 INTRODUCTION

Learning is a continuous life long process that not only helps to improve the knowledge of an individual in respective field but also overall development of individual, any group or society. In the traditional education or learning system teacher transfers knowledge to students in a confined classroom and neither students nor teachers have options to change the content of curriculum instantaneously. With the explosive fascination growth in mobile technology supported by wireless telecommunication technology changed the traditional classroom based teaching, and learners or students can access learning object anywhere anytime and any location. Web based technologies, wireless telecommunication technology, advanced mobile technologies and high speed internet connection provides various modern possibilities for the development of educational technology [1]. E-learning has made learning ubiquitous- ever present with the aid of personal computer (PC) and an internet connection by utilizing networks, whereas m-learning has added more portability or mobility to e-learning model with the aid of smart mobile devices.

Some of the limitations of m-learning restricted its development and popularization. M-learning has not effective or quality of the viewing content diminished due to small screen size of mobile and small keyboards are not satisfying standard ergonomics of inputs and these limits the textual communication and viewing of small chunks of data in mobile devices [2-3]. Some of the shortfalls are - (1) Mobile device screen is too small, unstable and limited memory size, (2) Lack of quality in teaching resource, (3) Reduced bandwidth, (4) High communication cost, (5) substandard format for learning courses and certification, (6) Lack of technical knowledge of teachers, (7) low standard in course material preparation and (8) Lack of integrated learning spaces.

Fourth Generation (4G) Mobile communication system is a new wireless device standard with features like improved data transfer rate, high security, customized and ubiquitous services, interactive multimedia, voice, video, wireless internet and other broadband services with high speed and capacity [4-5]. The International Mobile Telecommunications Advanced (IMT-Advanced) specifies some conditions or requirements for 4G, which includes speed of 100 Mbit/s or more while travelling and 1 Gbit/s while stationary, channel bandwidths of 5-20MHz or some time even up to 40MHz, all-IP based packet switching network and able to switch over multiple heterogeneous networks simultaneously. 5G (Fifth generation wireless systems) is emerging mobile telecommunication standard beyond 4G in terms of speed,

bandwidth, data transfer rate and signaling efficiency. Next Generation Mobile Network Alliance (NGMN) defines 5G with some requirements, which includes data transfer rate more than 1 Gbit/s and should support tens of thousands of users, up to several lacks of connection simultaneously and spectral and signaling efficiency should be more than 4G.

This paper proposes a modern m-learning system. This system is developed with the aim to provide customized or personalized and ubiquitous services with aid of 4G/5G wireless communication technology. Some of the specific advantages of 4G/5G communication technology can affectively solve the shortfalls of m-learning. The system is using WiMax, User Profile Filter and many other technologies to enhance mobile learning, which makes a complete m-learning system with services like video lecturing in multi disciplinary subjects, SMS and feedback for learners.

2.2 RELATED RESEARCH

M-learning is new learning model of e-learning, with the help of smart mobile phones and wireless networks. The initial Mobile learning system was based on Short Message Service, which also provided voice services along with SMS. M-learning is a new paradigm in which interaction between students and teacher improved without any barriers to classroom [6]. Brown et al. [7] conducted a case study on mobile learning environment using web2.0 and mobile devices, in order to explore how mobile technologies and social softwares can be used for collaborative learning, sharing, understanding and building virtual communities by considering different user requirements for the university students. Mobile learners can use SMS to transmit some limited amount of text between learners or to internet server and usually most of the students owns mobile phone, but only few students owns PDA[8].

Bailey et al. [9] demonstrated interactive and active learning techniques helps learners to acquire new knowledge, develop reasoning and critical thinking, responds to a problems differently and independently than others, where as in passive learning is on the teaching principle of transferring knowledge from teachers to students in verbal forms. Podcast- a downloaded series of audio or video files via computer is an effective revision tool compare to students their own note or text books and students having provision of flexibility to read notes anywhere, any time[10]. Ubiquitous learning system includes five types of situation parameters as Personal situation sensors, Environmental sensors, Feedback sensors, Personal database, Environmental database and some models of conducting ubiquitous learning

includes real world learning with online guidance, evaluation by identifying real world objects, real world observation with the help of online data searching and cooperative problem solving [11]. Using fourth generation mobile communication technology mobile learners can access learning materials like interactive courses, virtual online labs, interactive online testing and lab exercise training platform by utilizing all-IP communication networks and which uses variety of computer embedded devices in order to access multimedia information [12]. This research proposes a customized and ubiquitous learning through video lecturing for m-learning environment. Customized and ubiquitous learning system purpose is to provide an infrastructure to creating, storing, correcting and accessing video lecturing [11-13].

2.3 CUSTOMIZED AND UBIQUITOUS MOBILE LEARNING (CUML)-SYSTEM CONFIGURATION

The diagram of the CUML architecture is shown in Figure 2.1. The system has four components as Server (video lecturing provider), Client (Learners), Content Provider Engine and Sensor Network. Each component has different tasks.

2.3.1 Server

This component provides permission or privilege to video lecturing provider to access CUML-system services. It permits authorized video lecturing provider to upload the video classes' content, SMS and send announcements using WiMax.

Following are the some important function of server component.

- Administrating and maintaining all the system tasks
- Approve the registration request of learner.
- When a new video lecturing file is uploaded, sending SMS to all registered learner who are interested in that respective field.
- Initially, when a request comes from learner identify the learner interested field with the help of user profile database.
- After, first communication, store the registered user interested area information in database, so that server can avoid contacting with user profile data.
- Maps the standard format content to modalities through automatic process map.
- When user requested video file is not available in server database, content provider engine successfully searches user requested video file from web and returns to server.

- Loads the video file retrieved by content provider engine into its database for future processing of client request.

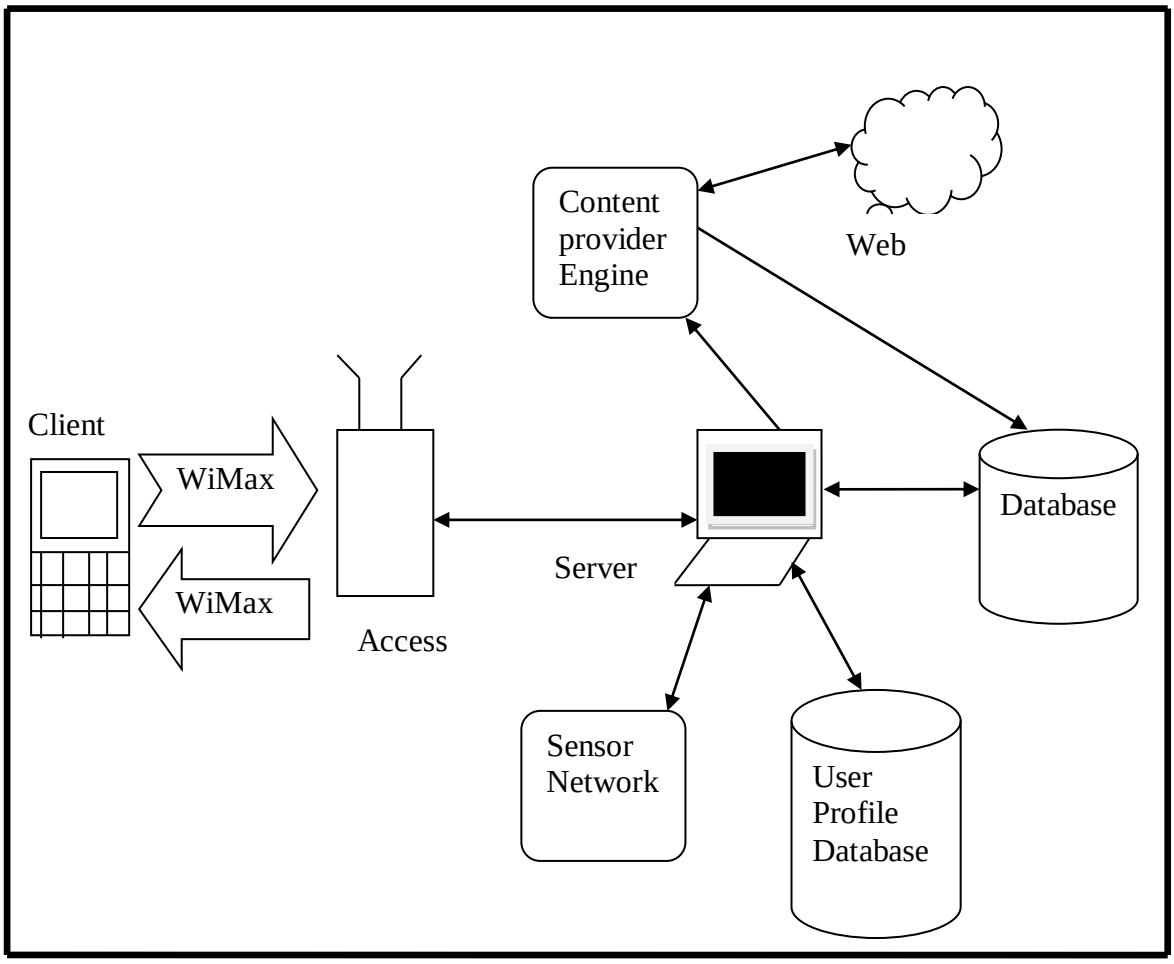

Figure 2.1: CUML-System Architecture

2.3.2 Client (Learner)

This component is related to the registered learners who have privileges to use the system. The learner can connect to server in order to access multi disciplinary subject's video lecturing classes. Following are the some important function of client component.

- Once registration is approved by the server, learner can login to the CUML system with valid user name and password.
- Receive the SMS from server informing new video lecturing class in respective field
- Learner can request for video lecturing class which includes duration of 1hour or more in multi disciplinary subjects
- User can change the password whenever required
- Learners can give feed back to the video lecturing class provider through server.
- Learners can discuss about particular video lecturing class through server.

2.3.3 Content Provider Engine

This component is useful, when the server is not able to find video lecturing class file requested by the client, server passes this request to content provider engine. Content provider engine search for the file in Web and finds the file. The new file is stored in database, so that when user requests for the same file, server process the request by retrieving the file from its database. Following are the some important function of content provider engine component.

- Successfully search the video lecturing class file from the web, when server is not able to locate.
- Store the new content in server local database
- Provide the content in one standard version or format.

2.3.4 Sensor Network

This component is used to automatically sense the user personal and environmental situations [11]. Following are the some important function of Sensor Network component.

- Identify the learner's location so that location specific video lecturing is provided to user
- On-body sensor can identify level of heartbeat and blood pressure in order to provide some video lecturing class related to that
- Environmental sensor includes temperature, humidity and air ingredients using that system is able to find situations or parameters around the sensor and to provide specific video information to user.

2.4 DESIGN OF THE SYSTEM

The server side component code (desktop application) was designed and implemented using

- NetBeans IDE 8.0.2 J2SE (Java 2 Standard Edition)

The client side component code (mobile application) was designed and implemented using

- NetBeans IDE 8.0.2 J2SE (Java 2 Micro Edition)

The user profile database and server database tables and DML queries are designed and implemented using

- MySql Server 5.6

Wireless communication was designed and implemented using

- WiMax
- HC-SDMA (High Capacity Spatial Division Multiple Access)
- AMC (Adaptive Modulation and coding) Adaptive Hybrid ARQ (Automatic Repeat Request)
- MIMO-OFDM (Multi in Multi out Orthogonal Frequency Division Multiplexing)
- Open distributed Ad-Hoc Wireless Network

Content Provider Engine was designed and developed using approaches as

- String matching analysis
- Bag of words analysis
- Signature Stylometry analysis
- Fingerprint analysis

Video file formats was designed and implemented using

- GPlayer
- DicePlayer
- MoboPlayer

For user feedback Application program was implemented using

- Microsoft office 2010

Sensor Network was implemented using

- Tiny-OS
- Hybrid 4G wireless Network Protocols

2.5 FEATURES OF CUML SYSTEM

The features of CUML systems are listed below.

- The system stores videos lecturing class of multi disciplinary subjects
- Learners can get their interested subject video lecturing class
- The system allows the user to access services ubiquitously
- The content provider engine can successfully access video lecturing files, when the server not able to locate it.
- The bandwidth and speed of the video files are highly improved due to the incorporation of 4G/5G Technology
- Sensor network can sense user location, temperature, heartbeat and blood pressure in order to provide highly customized or personalized video lecturing file or information to the user.

- CUML system provides better network for user with the aid of 4G communication network technologies, which includes WiMax, HC-SDMA, AMC, Adaptive Hybrid ARQ, MIMO-OFDM and open distributed Ad-Hoc Wireless Network.

2.6 CONCLUSION

M-learning provides great flexibility and freedom for the learners to lean anytime, anywhere, without any restrictions to physical barrier. The learning utilizes different hardware and software technologies and there is complete freedom of the learners to exist different location than the teacher. The proposed work in this study focused on how learners can acquire new knowledge through customized and ubiquitous video lecturing classes. The developed system is good user friendly and can improve mobile learning system. The server is accessed by the client through WiMax Wireless protocol that covers huge area compare to Wi-Fi and learners can get video lecturing classes of interested subject and can make m-learning personalized and more interesting. The server manages and administrates all the work of the system. Initially when user makes request for video lecturing server process the request by identifying user interest through user profile database. Server initially looks in its database to serve the request of client. If video file is not available server sends the request to the content provider engine. Content provider engine successfully searches user requested video file from web and returns to server. Server loads that video file in its database for future processing of client request. Sensor network can sense the client location and on-body features like temperature, blood pressure etc. and provide more personalized video lecturing file to the client. Through CUML system server sends announcement to clients, who are interested in the concerned subject, whenever that subject new video lecturing file is uploaded. Learners can give feed back to the video lecturing provider through server. The incorporation of 4G/5G communication technology features improves system speed, bandwidth, network, accessibility and availability. The emergence of 4G technologies not only provides platforms for transmission and interaction of teaching content, but also overcomes shortfalls of it and increases the possibilities of full interaction.

This paper and project described here will become active and supportive role to anyone who is interested in the field or researchers of m-learning. The most important individual might be benefited from this work are research teachers, students or educational organizations like universities or institutions.

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CHAPTER-3

A Customized and Flexible Ideal Mobile Banking System using 5G Technology

ABSTRACT

The word Ideal System refers to a system which is optimal or finest in terms of all its characteristics and any existing system can be improved or converted into the Ideal system by comparing existing system to Ideal system and by doing research and innovation. Mobile banking business will enable banking organizations to expand their markets, improve their services to all corners of the world without any barriers in terms of time, location and place. The rapid increase of mobile phone users is closely followed by security problems. The objective of this paper is to suggest some characteristics that will solve problems like security, bandwidth, network coverage, speed and much more. Fifth Generation (5G) mobile wireless communication technology an advanced modern upcoming technology that has significant change or difference in terms of bandwidth, speed access, and zone issues compare to its predecessors. In this paper, the concept of the Ideal mobile banking system is discussed, based on developing a suitable model with the predicted system and environmental characteristics which is ultimately very much user-friendly, customization and flexible in nature. To realize Ideal system model we have taken up 5G mobile wireless communication technologies and discussed how it will support Ideal mobile banking model by providing characteristics in terms of speed, bandwidth, data transfer rate, signaling efficiency and all advanced services. The paper makes an analysis of new model with its advantages, benefits, constraints, and disadvantages.

Keywords: Ideal Mobile Banking System, 5G Technology, Bandwidth, Customization, Flexible.

3.1 INTRODUCTION

The advancement in Information and communication technology resulted in rapid growth of wireless mobile communication technology across the world. The word ideal refers to a system which is having peak performance characteristics in all aspects and will be helpful or beneficiary to all stakeholders and to society. In mobile banking service, customer or service provider should not find any difficulties in order to use or provide services. Mobile banking is a new form of banking services to customers to access and perform transactions anytime, anywhere through their smart mobile phones, which includes financial or nonfinancial transactions, utility bill payment, recharging of mobile, TV etc. A service model or system called ideal system, when that must have the following characteristics:

(i) An ideal model/system should capable of incorporating changes in services, or inclusion/deletion/updating of new/old services with out affecting in its overall framework or performance.

(ii) Postulation made in the model/system should be minimal.

(iii) The service should be the accessible 24x7 basis, every day.

(iv) The user interface should be simple, user-friendly and highly explanatory.

(v) The response time should be very good.

(vi) The error rate should be zero or nullified.

(vii) Security should be very high or unauthorized access or use data by the unregistered user should be prevented.

A German company Paybox in collaboration with Deutsche Bank at first launched mobile banking in late 1990. In the beginning decade of the 21 century, some developing countries started introducing mobile banking services in that Kenya was the first developing country introduced m-banking service called M-Pesa, in 2007. Researchers used various terms for mobile banking, Amin et al., (2006) referred mobile banking as pocket banking, Ivatury and Mas, (2008) as branchless banking, while Donner and Tellez, (2008) called m-payments, m-transfers, m-finance and Liu et al., (2009) named as m-banking [1-4]. In Mobile Banking an ideal system refers a service system which is equally substitutable for all banking services. An ideal system should fill the gap between manual banking services and automated online banking services.

In this paper, we discuss an ideal mobile banking system which is finest in terms of all its characteristics or fulfills every aspects or need of users. Fifth Generation (5G) mobile wireless communication technology is an advanced modern upcoming technology. This paper

discusses adoption of 5G technologies in mobile banking services and how this new technology significantly improves bandwidth, speed access, and zone issues. An ideal system is discussed with characteristics in terms of communication technology.

The Paper is structured under seven Sections. The First section describes an introduction to 5G Technology and definition of Ideal System. Section Two narrates about the ideal system in terms of communication system characteristics. Section Three describes characteristics and functions of 5G technology. The Section Four describes Ideal Mobile Banking System with its components and subcomponents with its technology and benefits. Section Five explains about applications of Ideal Mobile Banking System in Banking Functions. Section Six makes a real attempt to analyze the Ideal Mobile Banking System Model with its Advantages, Benefits, Constraints, and Disadvantages. Section Seven concludes the paper.

3.2 IDEAL SYSTEM

It is well known that we can improve the performance of any system by comparing it with a hypothetical, predicted system of that kind called "Ideal system" [5-9]. The word ‘Ideal system' refers to the system which has utmost characteristics, which cannot be improved further. It is what our mind tells ultimate and which reached the pinnacle of success in the respective field, which can be compared to all other systems of similar type, which lacks in some qualities [10-14]. The less-efficient system can be converted into the ideal system with the aid of research and continuous innovation in that field. Many objects we can consider as ideals like an ideal gas, ideal fluid, ideal engine, ideal switch, ideal voltage source, ideal current source, ideal semiconductor and ideal communication technology and all of these are considered as standards to improve the quality and performance of similar type. The ideal system of any kind can be placed in mind, while improving the characteristics of practical devices/ systems and reach ideal system or considered to be a pinnacle of success. Some of the ideal systems with respect to Telecommunications are listed in Table 3.1.

Table 3.1: List of Ideal components with respect to Telecommunications

Sr. No.	Ideal Systems/ Components	Definition of ideal Systems/Components
1	Ideal Bandwidth	The Volume of information per unit of time that a telecommunication system can handle is unlimited or uncountable.
2	Ideal Speed	The time is taken in order to download or uploaded files are within a second or negligible time.
3	Ideal Data Transfer Rate	Any amount of data can be transferred source to destination within a few seconds.
4	Ideal Signaling Efficiency	The quality of the signal is 100% efficient in all aspects.
5	Ideal availability	Signal or services can be available any part of the world at any time i.e. 24 * 365 days without any disconnection.
6	Ideal Security	100% Protects personal information against misuse or unauthorized access or highly robust security.
7	Ideal roaming	Worldwide interoperability and roaming between operators, between users and service providers all time. The switching between operates should take place freely..
8	Ideal Voice Quality	Capacity to carry all types of voices all time, all over the world, based on user's request.
9	Ideal Video Quality	Capacity to carry all types of videos without barriers to size, time and place. 100% efficient video without streaming or buffering.
10	Ideal Content	Highly rich content without any difference between moving content and ideal content. The content can be data, audio or video.

3.3 FIFTH GENERATION (5G) TECHNOLOGY

Fifth generation mobile wireless technology is future wireless communication technology, which is not become reality as of now. But 5G aims to achieve very much higher capacity than current 4G in terms of many aspects of broadband user per unit area, bandwidth, speed, availability, super fast video services and many more fascinating and professional services.

With the aid of 5G technology large population of the user can see and download audio, video, or any other multimedia services, without any restriction in terms of continuous, nonstop services with high efficiency [15-17]. The next generation mobile network alliance list out some standards for 5G technologies, which will cater the need of many wireless telecommunication based systems like mobile banking and e-learning, etc. It defines 5G technology in terms of several features [18-19] as

- Data rates of ten to fifteen of megabits per second for tens to fifteen of thousands or millions of users.
- Data rates 100-150 megabits per second or more for metropolitan areas focusing on more customers and retaining existing customers.
- The speed of more than 1-2 Gigabits per second simultaneously to many customers on the same office floor focusing on nearby area groups.
- Information rate that can be transmitted over specified bandwidth or spectral efficiency will be highly improved compared to 4G technologies using some advanced 5G technology.
- Billing services can be customized based on user requests and virtual private network.
- The virtual presence and virtual navigation can be highly improved compared to 4G technologies, especially in gaming 3D visualization and 3D image processing applications.
- Uploading and downloading speed of 5G technology are going to be improved and it will be in the rate of Terabytes or Petabytes, which is very much high compared to present 3G and 4G technology.
- 5G technology expected to have an extra ordinary capacity to support different types of software and hardware interfaces which will cater the need of different high-performance systems.
- Multimedia services with ever seen efficiency anywhere, anytime and anyplace or ubiquitously, which will enrich and make fascinating different gaming and simulation systems.
- 5G technology is promising to provided services without affecting to human health or eco-friendly and environment-friendly.

3.4 IDEAL MOBILE BANKING SYSTEM

Ideal Mobile Banking System is a system which has properties like highly user-friendly, ubiquitous services, always available, very cheaper and 100% efficient in all aspects of banking or financial transactions [20-24]. As shown in Figure 3.1, we have proposed an Ideal Mobile Banking Model, which consists of different components like Ideal Security, Ideal User-Friendly, Ideal Multimedia Services, Ideal Transactions, Ideal Loan Services and Ideal Auxiliary Services [25-28].

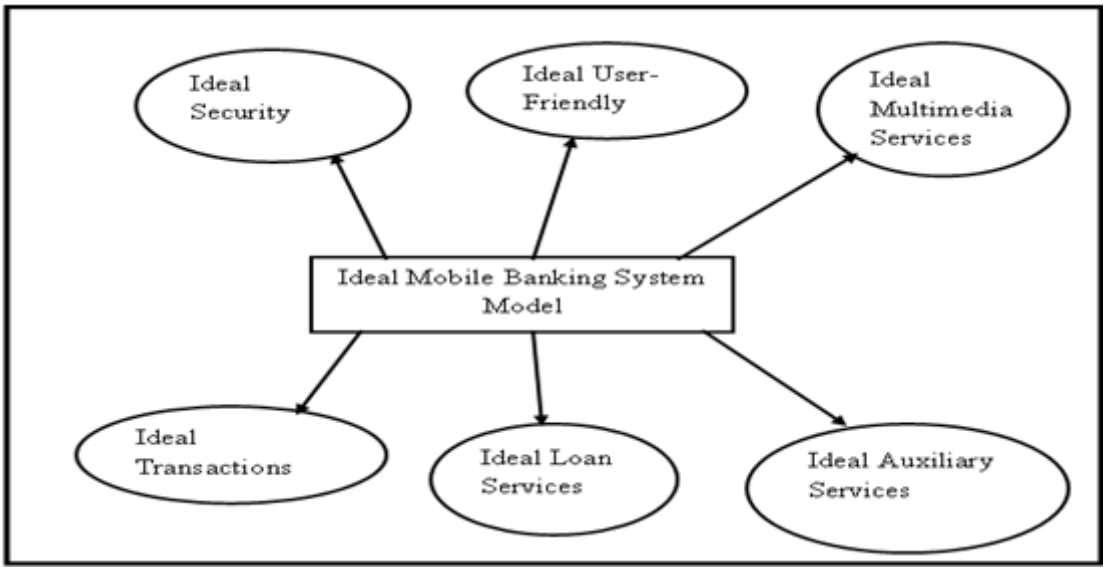

Figure 3.1: An Ideal Mobile Banking System Model

A. Ideal Security

In Mobile Banking, Security refers Authentication, Confidentiality, Integrity, and Non-repudiation. These are referred using an ideal system as follows.

Ideal Authentication: Able to confirm that sender has right to send the message and receiver has the right to receive the message. A very strong or 100% secured authentication such that it ensures that the transaction takes place between only registered or already known parties. This can be achieved using multimodal and multilevel biometrics and other security measures with the aid of 5G technology.

Ideal Confidentiality: Message is encrypted in such a way that other than receiver and sender, no one else can be able to decrypt the message in any conditions. A very high or optimal password generating algorithm and a ciphering algorithm is used to implement Ideal confidentiality.

Ideal Integrity: Data is never altered or changed during its entire journey or transmission time while travelling from the source to destinations through various nodes. If the data is altered or compromised during transmission, the advanced hashing algorithm will generate a different digest value at the receiver side which will help the receiver to know that message has been altered during its transmission and receiver will reject the data. Ideal Integrity ensures that data never alters or if alters identified by the receiver and requests for re-transmission [29].

Ideal non-repudiation: Only the sender and receiver of the message are supposed to have the one-time password or security key and ideal Non-repudiation ensures that no other persons acquire security key. Each pair of one-time password and the sequence number is only allowed to be used for a single user and expires after its use within fraction of the time. Therefore the sender cannot deny not sending the message and receiver cannot deny not receiving because only those specific users have that unique pair of a password and sequence number to encrypt the message and it ensures that no one else can get OTP. Table 3.2 shows Ideal Security Components Technologies and Benefits.

Table 3.2: Ideal Security Component's Technologies and Benefits

Sr. No	**Security Sub Components**	**Technologies**	**Benefits**
1	Ideal Authentication	Multimodal Biometrics like-two Fingerprints, voice recognition, etc.	Only Authenticated user get access to the system.
2	Ideal Confidentiality	Optimal password and ciphering algorithm based on hash functions.	Decrypting of the message by the unknown user becomes impossible.
3	Ideal Integrity	Random Chaff Point Creation based on hash functions.	Data never alters or if alters identified by the receiver and requests for re-transmission.
4	Ideal non-repudiation	Special Onetime password which involves multiple factors.	Sender and receiver cannot deny sent and received messages.

B. Ideal User Friendly

Ideal Mobile Banking Facility should be very much user-friendly for customers mean zero tolerance or difficulty while using facility or services. The user-friendly feature includes services like Ideal Availability, Ideal Data Freshness, Ideal Speed, and Ideal Bandwidth.

Ideal Availability: The services should be available to all customers anytime, anywhere, any place without restriction to time and place or simply ubiquitously with 24* 365 days basis. The user should able to access mobile banking services from geographically dispersed locations. The time it takes for a message to be delivered, usually depends on the density of nearby network operator base towers and ideal availability can ensure that base tower can accommodate any capacity of network load or density efficiently and effectively. In Ideal Mobile Banking System any number of transactions that the server can handle at once with ideal hardware capability. If the server hardware can handle hundred of multiple incoming messages then the server can handle multitasking or multiprogramming and simultaneously serve the user requests within no time.

Ideal Data Freshness: The data, which is accessed or consumed by the user, should be fresh and ensures that no old message is replayed or re-transmitted. Ideal Data Freshness ensures that it is minimal or zero replayed attacks.

Ideal Speed: The speed at which user can upload or download any multimedia files can be measured in terms of Petabytes or more. Ideal speed ensures that mobile banking any transactions can be executed within no time or fraction of seconds.

Ideal Bandwidth: Volume of information per unit of time that mobile banking system can handle is unlimited or uncountable. Ideal Bandwidth ensures that all types of data can be reached to any locations within a fraction of the second.

Table 3.3 shows Ideal User-Friendly components technologies used while developing the system with the aid of 5G Technology, and also includes its benefits. The Ideal User-Friendly component should ensure that mobile banking system should be very much user-friendly to a user without any difficulty and should complete within no time and all facilities within the fingertip of a user.

Table 3.3: Ideal User Friendly Component's Technologies and Benefits

Sr. No	**User Friendly sub Components**	**Technologies**	**Benefits**
1	Ideal Availability	High configuration hardware's, more number of receiving	Services available to all customers anytime,

		towers, high capacity satellite communications and Advanced 5G technologies.	anywhere, ubiquitously with 24* 365 bases. Services all time, all days of the year.
2	Ideal Freshness	Nonce and time-related counter.	The data, which is accessed or consumed by the user, fresh and ensures that no old message is replayed or re-transmitted
3	Ideal Speed	Open-distributed Ad-hoc network, high capacity MIMO-OFDM, HC-SDMA	Any transactions or applications can be executed within fraction of seconds.
4	Ideal Bandwidth	High capacity Spectrum, more capacity frequency band and Time Division Duplexing (TDD)	All types of data can be reached to any locations within a fraction of a second.

C. Ideal Multimedia Services

Ideal Multimedia Services component of Ideal Mobile Banking System Model consists of Ideal Data, Ideal Audio, Ideal Video and Ideal Broadband.

Ideal Data: This ensures that any type of data, in terms of size and file type can be transferred or moved between source and destinations without any restrictions in any aspects. Data can be easily added deleted or can be used in any type of financial or nonfinancial transactions.

Ideal Audio: High capacity audio can be transmitted, uploaded or downloaded within a fraction of seconds. The quality of Audio is 100% perfect in all qualities. Audi signal is having some ideal qualities like higher sampling rate with more bits per sample or Bit rate, instantly cut and audio file in half to convert stereo to mono, optimal file size with lossy compression and universal compatible file format.

Ideal Video: Full High-Density Video (Full HD-VIDEO) can be transmitted to any source to destination, all over the world without any restrictions in terms of time, size and locations. Live Streaming Video can be broadcasted to any locations efficiently and effectively.

Ideal Broadband: Without hotspot mobile users can connect to the internet and access seamless broadband services across the world. Ideal broadband services will be having features like always connected, omnipresent, high speed and high efficiency.

Table 3.4 shows Ideal Multimedia Services technologies used while developing the system with the aid of 5G Technology, and also includes its benefits. The Ideal Multimedia Services component should ensure that mobile banking system should be very much efficient in handling audio, video and data files of any size.

Table 3.4: Ideal Multimedia Services Component's Technologies and Benefits

Sr. No	**Multimedia Sub components**	**Technologies**	**Benefits**
1	Ideal Data	Advanced OFDMA Flat Architecture, True Packet Switched, Unified IP	Data can be easily added deleted, uploaded, downloaded and transmitted to any locations easily and effectively.
2	Ideal Audio	Advanced optimal Lossy Compression, High Sampling Rate, More Bitrate, VoLTE	High capacity audio can be transmitted, uploaded or downloaded within a fraction of seconds. The quality of Audio is 100% perfect in all qualities.
3	Ideal Video	Advanced base-station Backhaul, Ultra-Wide Band Networks, Smart Antennas	Full High-Density Video (Full HD-VIDEO) can be transmitted to any source to destination, all over the world without any restrictions in terms of time, size and locations.
4	Ideal Broadband	WiMax enabled XOHM Broadband, seamless combinations of Broadband, All IP Based Mobile Multimedia Core Network	Without hotspot mobile users can connect to the internet and access seamless broadband services across the world. High-capacity Internet Services.
4	Ideal Broadband	WiMax enabled XOHM	Without hotspot mobile users

		Broadband, seamless combinations of Broadband, All IP Based Mobile Multimedia Core Network	can connect to the internet and access seamless broadband services across the world. High-capacity Internet Services.

D. Ideal Transactions

Ideal Transactions component of Ideal Mobile Banking System Model includes Ideal Digital Deposit, Ideal Digital Withdrawal, and Ideal Money Transfer. Ideal Transactions ensures that customer should able to perform banking transactions easily, effectively and zero tolerance or effort. The customer should do every banking transaction without actually visiting bank branches or virtually from any places.

Ideal Digital Deposit: Customer should able to deposit cheque using their mobile phone, from any place, at any time. The user takes an image of the cheque using the camera of smartphone and sends that image to the bank server, server process the request and deposits required the amount to the users account. In Ideal Digital Deposit, depositing should become as simple as depositing money in old fashion paper cheque, without any queuing system.

Ideal Digital Withdrawal: Customer should able to handle money without physically Withdrawing money from their account, which means that customer should able to do any transactions without carrying money physically. All transactions related to money will be carried out online. Ideal Digital Withdrawal ensures that customer should not find any difficulty to handle online transactions or digital money, which will be very simple and everyone should able to do it without any effort.

Ideal Money Transfer: Customer can transfer money to self or others, within the same bank or other banks ubiquitously with zero effort or tolerance. Ideal Money Transfer ensures that money is transferred to any account all times 24*365 days of the year basis.

Table 3.5 shows Ideal Transactions technologies used while developing the system with the aid of 5G Technology, and also includes its benefits. The Ideal Transactions component should ensure that mobile banking system should be very much efficient in handling banking transactions with zero effort or tolerance.

Table 3.5: Ideal Transaction Component's Technologies and Benefits

Sr. No	Ideal Transactions Sub components	Technologies	Benefits
1	Ideal Digital Deposit	Advanced Mobile Camera, IP Based Radio Access Network,	Depositing should become as simple as depositing money in old fashion paper cheque, without any queuing system
2	Ideal Digital Withdrawal	Packet Data Serving Node, Base Station Controller, W-CDMA	The customer should not find any difficulty to handle online transactions or digital money, which will be very simple and everyone should able to do it without any effort.
3	Ideal Money Transfer	Packet Data Serving Node, Base Station Controller, W-CDMA, Wi-Max	Money is transferred to any account all times 24*365 days of the year basis.

E. Ideal Loan Services

Usually, in the present scenario, a customer finds difficulty, while taking a loan from the bank. Before sectioning a loan bank has to verify several documents if documents proper then the only bank will provide a loan to customers. Also, it should evaluate several eligibility criteria before providing a loan. All these processes take several days or months. An ideal Loan service includes house loan, Vehicle loan and personal loans.

Table 3.6 shows Ideal Loan Services technologies used while developing a system with the aid of 5G Technology. The Ideal Loan Services component should ensure that mobile banking system should be very much efficient in and handling Loan services with low time duration efficiently.

Table 3.6: Ideal Loan Services Component's Technologies and Benefits

Sr. No	Ideal Loan Services Component	Technologies	Benefits
1	Ideal Loan Services	High-Density Video Conferencing, Advanced VoLTE,	The effort and time should be reduced for customers while availing loan services from the bank. Customer should not find any difficulties while availing House Loan, Vehicle Loan, Personal Loan and any other types of Loan.

F. Ideal Auxiliary Services

Mobile Banking System can be used for many purposes other than banking financial or nonfinancial transactions. Mobile Banking System can be used for LIC premium payment, Gas Booking, Mobile Recharge, Income Tax payment, D2H recharge, Grocery purchase or any other types of purchases. Ideal Auxiliary Services ensures the user can able to all these services without any effort or difficulty. Table 3.7 shows Ideal Auxiliary Services technologies used while developing a system with the aid of 5G Technology, and also includes its benefits. The Ideal Auxiliary Services component should ensure that mobile banking system should be very much efficient in handling Auxiliary services efficiently and as like they do manual transactions.

Table 3.7: Ideal Auxiliary Services Component's Technologies and Benefits

Sr. No	Ideal Auxiliary Services Components	Technologies	Benefits
1	Ideal Auxiliary Services	Advanced H-CDMA, Ad-Hoc Networks, AMC, MIMO-OFDM, Advanced WiMax	All the money related services other than banking services can be able to perform with zero tolerance and user should find it utmost user-friendly.

3.5 APPLICATIONS OF IDEAL MOBILE BANKING SYSTEM

As shown in Table 3.8, in this section we discuss each component of Ideal Mobile Banking System Model and its applications in various mobile banking services in Tabular Form. Ideal Mobile Banking System includes different components as Ideal Security, Ideal User-Friendly, Ideal Multimedia Services, Ideal Transactions, Ideal Loan Services and Ideal Auxiliary Services.

Table 3.8: Ideal Mobile Banking System-Applications

Sr. No	**Ideal Banking System Components**	**Ideal banking System Sub-components**	**Applications**
1	Ideal Security	Ideal Authentication	Only Authenticated user get access to mobile banking portal
		Ideal Confidentiality	While sending messages in the mobile banking system, decrypting of the messages by the unknown person becomes impossible.
		Ideal Integrity	In Mobile Banking System, while transmitting data through a network, data never alters or if alters identified by the receiver and requests for re-transmission.
		Ideal non-repudiation	In Mobile Banking System, sender and receiver cannot argue that they have not sent or received the transmitted message.
2	Ideal User-Friendly	Ideal Availability	Mobile Banking Facility is available ubiquitously.
		Ideal Freshness	User will receive fresh and updated data while using Mobile Banking System.
		Ideal Speed	Mobile Banking Services or transaction speed is very high in terms of Petabytes.
		Ideal Bandwidth	Mobile Banking System Bandwidth will improve; it may be several hundred times of present bandwidth.
3	Ideal	Ideal Data	Mobile Banking System will accommodate

	Multimedia Services		high capacity data, which can be uploaded, downloaded at any time without any effort. Data can be transmitted easily through the network.
		Ideal Audio	Mobile Banking System can utilize high capacity audio, which will be very useful while calling.
		Ideal Video	Mobile Banking System will witness high capacity video conferencing services.
		Ideal Broadband	Mobile Banking System will enrich with super fast and super efficiency broadband services which will help in video conferencing, and all type of high volume transactions.
4	Ideal Transaction Services	Ideal Digital Deposit	Mobile Banking System will support for digital deposit of cheque easily anywhere, anytime.
		Ideal Digital Withdrawal	Mobile Banking System will support for digital or cashless transactions.
		Ideal Money Transfer	Through Mobile Banking System users can transfer money to self or to any account without any barriers in terms of time, place, and locations.
5	Ideal Loan Services	Home Loan, Vehicle Loan, and Personal Loan	Mobile Banking System will reduce the hurdles and efforts of availing loan facility for customers.
6	Ideal Auxiliary Services	D2H recharge, Mobile recharge, Gas booking, and online purchases etc.	Mobile Banking System will support for all auxiliary or subsidiary services efficiently, which will greatly reduce the burden of users in the payment process.

3.6 ANALYSIS OF IDEAL MOBILE BANKING SYSTEM

The Ideal Mobile Banking System is analyzed in terms of its advantages, Benefits, Constraints, and Disadvantages. Ideal Mobile Banking System model is a conceptual model that ensures some ideal characteristics like better availability, accessibility, user friendliness features, security, speed and Bandwidth with the aid of 5G technology.

Advantages

- Ideal solution for paper-free Banking Transactions
- Transaction facility anywhere, anytime and constraint-free or ubiquitously
- Digital deposit of cheque makes customer effort free and time saving
- Ever seen, ever imagined Speed, Bandwidth, security due to 5G technology
- Bill payment makes simple and effortless
- Automatic digital withdrawal helps to improve cashless society
- Smart Phone Credit Card Scanning improves security of customer PIN
- Electronic meeting and video conferencing save customer time and simple.
- Highly user-friendly and interactive interface
- Always available data is updated and fresh
- All bills can be paid without visiting respective offices or from remote place easily
- Usage experience of smartphone helps to learn the mobile banking
- 5G Technology makes services more attractive, effective, and omnipresent and ubiquitous
- Unified single standard for wireless communication and global roaming facility due to 5G Technology

Benefits

- Global expansion of Smart Phone banking services helps to acquire new customers or to retain the existing customers all over the world
- The ability to obtain a larger customer pool and appreciations due to ideal and ubiquitous services.
- Enhances reputation of the bank by providing fast and secured, always available and ideal services to its customer.
- The ability to take advantage of the growing popularity of Smart Phone banking through Digital Deposit, Digital Withdrawal, and Auxiliary Services makes customer effort free and happy.

- Banks can able to attract all types of busy schedule customers, which includes Business people, Software engineers or other tight scheduled customer pool.
- Improves customer satisfaction and faithfulness
- Loan services can be effectively improved that helps to improve the bank turnover

Constraints

- 5G Technology is not yet developed, so many functionalities of 5G technology not known
- High cost to implement services
- Computer and mobile literacy is compulsory to use the system
- Lack of technical support
- Lack of trained and skilled persons
- Realizing ideal quality in all areas is very difficult

Disadvantages

- Requirement of high memory, processors and latest technology at Bank's servers
- Possible failure to achieve ideal qualities in all areas
- Lack of technically sound staff
- Initial investment in technology will be expensive, which will slow down the starting of new services initiation by the bank
- Lack of trained staff
- Electronic meeting some time misused by the customers in loan services
- 5G Technology become more expensive during its initial design and implementation

3.7 CONCLUSION

Ideal systems are those systems which will be comparable to any other system and system which wants to improve can take reference as that system and steps forward to achieve the pinnacle of success in every aspects. The 5G, future advanced wireless communication technologies will offer a variety of services like mobile internet, mobile commerce, and bill payment services with ever pleasant, highly sophisticated and super fast nature and will utilize advanced technologies like OFDMA, IP Based Radio Access Network, Packet Data Serving Node, Base Station Controller and W-CDMA, etc.

In this paper we tried to explain Ideal Mobile Banking System Characteristics through Ideal Mobile Banking System Model which includes different components like Ideal Security, Ideal User-Friendly, Ideal Multimedia Services, Ideal Transactions, Ideal Loan Services and

Ideal Auxiliary Services. Each component has some sub components. We explained each components and sub components technologies and benefits through tabular the form. We also explained applications of these components in Mobile Banking Scenario. Finally we analyzed new model using its advantages, Benefits, Constraints, and Disadvantages.

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CHAPTER-4

A Study on Online Education Model using Location Based Adaptive Mobile Learning

ABSTRACT

Online educations are gaining more scope due to the busy schedule of working groups and their interest to acquire knowledge in new fields. Working group people find difficult to get admission in top institutions for their interested course due to competition and lack of time flexibility. Regular full-time university affiliated courses become lack of interest for the working group due to outdated curriculum, lack of innovation in teaching, unchanged learning and evaluation environment and lack of industry oriented advanced courses. Some institutions/universities provide short-term online courses for working people, which are liked by many working people due to its new evaluation and learning methods, advanced curriculum and industry oriented subjects. The introduction of mobile wireless communication technology modernization, innovation and globalization are increasingly driving the online education to become ubiquitous, personalized, convenient, and flexible for working groups. In this paper, we discuss based on the location how some short term certification courses can incorporate changes in curriculum. In this paper, we discuss when a particular university introduces some certification courses worldwide, how concepts, regulations or entire subject changes depending on the geographical location. At the time of registration location of the user is accepted from the user. If the registered user changes the location for more than two weeks then that is traced by GPS through the mobile phone and curriculum content changes a little bit. Initially, this is introduced only for some competitive examinations material and short term certification courses related to commerce and political science, which is slightly different depending on the location. This paper discusses how in online short term certification courses, changes in curriculum and innovation in teaching, learning, and evaluation can be implemented for the benefits of working people located in different geographical regions of the world.

Keywords: Location Based Learning, GPS, Certification Courses, Wireless Communication Technology.

4.1 INTRODUCTION

Online educations are learning with the aid of technology without physically visiting institutions or organizations. Technology includes computers, mobile, smartphone and wireless communication devices. The development of internet technology and wireless communication devices made learning ubiquitous. Higher education institutions are adopted virtual learning environment and adopted e-learning, through which working people are getting benefited. Learning is a continuous learning process which starts from the birth to death of the human being which helps to develop individual and thereby gaining new knowledge [1]. The traditional education system is static, which means that student is not having the rights to change the content of curriculum or topic of the subject instantaneously and teacher transfers knowledge to students in a confined classroom. Learning with the aid of mobile device or m-learning is not effective or popular due to some constraints, they are: (1) small screen size, (2) lack of quality in teaching content, (3) reduced bandwidth, (4) high communication cost, (5) substandard format for learning and certificate, (6) lack of technical skills of teachers, (8) lack of integrated space and lack of one to one communication or eye contact [2-4]. Fourth Generation (4G) communication technology is an advanced wireless standard which can overcome some of the constraints of m-learning, which includes improved transfer rate, customized and ubiquitous service, interactive multimedia and broadband and multimedia services with high speed and capacity [5-8]. The advanced smartphone is having high capacity, memory power and speed compare to an earlier mobile phone, which helps to improve online education journey through them.

Location information of the particular user or student helps to improve studying environment of the student and in providing location-relevant current information in the curriculum or on the subject. Location information is used in m-learning users to retrieve user's current location and further process that data to acquire more information near to their current location and to provide add-on information to users [9-10]. Location information can be extracted with the help of GPS system, which comes in almost all smartphones. Location information can be used for the authentication purpose also. Location Authentication mainly involves three components as Proximity component, Authentication Factor Components, and Known Location Components.

This research Paper is divided into seven sections. In the first section, we cover introductions to online education and location information. Section two explains about the related research study. Section three describes problem statement and objectives of the study. The section four

covers Model describing location based information for m-learning. Section five describes conceptual design requirements for the model. Section six makes an analysis of location-based adaptive learning using Advantages, Benefits, Constraints, and Disadvantages. Section seven concludes the study.

4.2 RELATED RESEARCH

A fair number of researchers have been published in the area of m-learning and Location based information. M-learning is a new learning model of e-learning using portability and immediate communication properties of wireless communication device fused with fast internet service with the aid of advanced smartphones [11]. M-learning is a new paradigm of online learning in which interaction between students and teacher improved and accessible at any without any barriers to classroom [12]. Mobile devices together with other wireless communication devices and internet have made the teaching of English language as a second language easy and more attractive [13]. The study reveals that mobile learning helps to improve the performance of students despite their division based on language, religion, class, and community. The experimental study was conducted among the distance learners of Vinayaka Mission University at Salem in India [14]. The virtual classroom can support urgent and timely need of the students and thereby improve learning process effectiveness. The teacher can teach the student, sitting at residence and students located around 1Km away from the teacher can form an ad hoc network [15]. Processing learner's contextual information through some devices and delivering adaptive and context-aware educational scenario using mobile device becomes vital to achieving adaptive and personalized mobile learning [16]. To adapt, manipulate and display a web-based framework is presented using small handheld devices. Written text files are converted into natural speech files [17].

Context-aware computing application often implemented for mobile devices and most of the applications solely rely on location information as their sensor information. A location based information most common form of context-ware based sensor information [18-19]. Location-based services are mainly classified as location tracking and Location aware [20]. The guide project and cyber guide and most of the other applications use the positive aware approach with the meaning that application's actions are based on its own positions. Locations tracking services are mainly based on safety based used mainly for tracking student or elder person or any missing persons [21-22]. In most of the location-based information, privacy is the one of an essential issue and is often addressed how sensitive information is kept secured in the

applications. The major difference between a location based attribute and other attribute is that location information changes continually and is most relevant to mobile computing.

4.3 PROBLEM STATEMENT AND OBJECTIVE OF THE STUDY

In traditional classroom based learning, in order to change curriculum or syllabus of the particular course, usually, it takes many years even after the particular subject has witnessed drastic changes over the years. Students are not having the flexibility to change the content or decide their curriculum and its always particular course board of study's decision. In contrast to traditional classroom-based teaching, m-learning has the flexibility for students to take the class at anytime from anywhere without physically sitting inside a classroom. Through context and sensor based customized and ubiquitous services, students can get knowledge as per their requirements and they can decide or contribute to the development of the curriculum [1].

Consider an example a material prepared for competitive examination may not fit well for all places. Generally, a competitive exam consists of different areas as Quantitative Aptitude, Logical Reasoning, and English comprehension, Computer Knowledge and General Awareness and General Knowledge. In this, General Awareness and General Knowledge covers wide areas and it varies from state to state or province. So an organization or institution cannot develop a material that is useable in all state level government competitive examinations. Consider another example where some professional certificate courses related to political science, income tax related subject, law-related subjects having different rules or conditions or changes with respect to States or province of a country.

The aim of this paper is to include location information in m-learning, which will be helpful for students of different regions to avail good dynamic updated content for some competitive examination preparing material and continuously changing topics with respect to place. The central objectives of the study are as follows:

- To study a conceptual model for location-based information for m-learning using GPS.
- To analyze the model with its Advantages, Benefits, Constraints, and Disadvantages

4.4 LOCATION BASED ADAPTIVE MOBILE LEARNING–SYSTEM CONFIGURATION

Location information of the user is highly important data in Location Based Adaptive Mobile Learning (LBAML). This can be one of the key attributes to change the content of a material

or to add more information to the already existing content. In this model, we will be using GPS device, especially GPS receiver to track the geographical position of the user and to provide content based on this data. The task of the GPS receiver is to track latitude, longitude and altitude coordinates of the user, who is trying to access the content of the respective material [23-25]. Once the location sent by the particular user is processed by the server, he will be able to access modified content of the material from geographically dispersed locations. One user can select more than one location at the time of registration. In registration process the user has to register location information along with his/her personal information. The user gets access to material after evaluating User-id, password and location information. The important information about the user like username, password, location information and other personal information's are stored in a cloud database. The diagram of the LBAML architecture is shown in Figure 4.1. The system has four components as Server, Client (Learner), Location Tracking System and Content Provider Engine. Each component has different functions.

A. Server

The Server provides permission or privilege to particular subject material like general awareness and general knowledge of competitive examination material to upload the material content SMS and send an announcement to all registered user using WiMax. Following are some important functions of Server component.

- Administrate and maintain all the system tasks.
- Approve the registration request made by the user. Registration details are stored in user profile cloud database.
- When a new material or some video clip file is uploaded, send SMS to all registered learner who is interested in that respective field.
- Initially, when a request comes from learner send a request to Location Tracking system to know the location of the user.
- Get the response from Location Tracking system and provide access to material based on the location based information.
- After knowing the location of the user, request content provider engine to provide new content based on location information.
- Loads the content or material retrieved by the content provider engine to its database for future processing of client request after evaluating location credentials.

B. Client (Learner)

This component is related to the registered learners who have privileges to use the LBAML system. The learner can connect to the server in order to access content or material of the particular subject. Following are some important function of client component.

- Once the registration is approved by the server, the learner can log in to LBAML system with a valid username, password, and location information.
- Receive SMS from the server stating that new video clip or new information of particular content is uploaded.
- User can change password if required
- The learner can give feedback to the content or material through the server.
- The user can select more than one location at the time of registration.

C. Location Tracking System

The location Tracking System helps in finding the location of the registered user. Location Tracking System main component is Global Position System (GPS). GPS receiver keeps track location of the user. Location Tracking System uses Google Maps database to find locations details. Following are some important function of Location Tracking System.

- Identify the learner's location so that location-specific content or material is provided to the user.
- GPS receiver keeps track latitude, longitude and altitude coordinates of the users, who are trying to access the content of the respective material.
- GPS Receiver keeps track of time stamp and date stamp in order to know when the user was at which location and time. For this Location Tracking system uses telecommunication system time in order to maintain standard time.
- If the registered user changes the location for more than two weeks then that is traced by GPS receiver through the mobile phone and curriculum content changes according to a specific location.

D. Content Provider Engine

Content Provider Engine acts as a bridge between Location Tracking System and cloud database. When the server is not able to find content or material file requested by the client, the server passes this request to Content Provider Engine. Content Provider Engine searches for the file in cloud database and finds the file. The new file is stored in the local database so that when user requests for the same file, server process the request by retrieving the file from its database. Following are some important function of content provider engine component.

- Successfully search the content or material from the cloud database, when the server is not able to locate or find the requested file.
- Helps to store the new content in server-local database for the future reference
- Provide the content in unique standard version or format.
- Assists for the smooth functioning of LBAML system.

4.5 DESIGN OF THE SYSTEM

The server side component code (desktop application) was designed and implemented using

- NetBeans IDE 8.0.2 J2SE (Java 2 Standard Edition) i.e. based on Java Programming. The client side component code (mobile application) was designed and implemented using
- NetBeans IDE 8.0.2 J2SE (Java 2 Micro Edition) i.e. based on Java Programming. The user profile database cloud database, server database and Content Provider Cloud database tables and DML queries are designed and implemented using
- MySql Server 5.6 .Wireless communication and network was designed and implemented using Standard of 4G communication technology
- WiMax
- HC-SDMA (High Capacity Spatial Division Multiple Access)
- AMC (Adaptive Modulation and coding) Adaptive Hybrid ARQ (Automatic Repeat Request)
- MIMO-OFDM (Multi in Multi out Orthogonal Frequency Division Multiplexing)
- Open distributed Ad-Hoc Wireless Network Content provider engine was designed and developed using
- NetBeans IDE 8.0.2 J2SE (Java 2 Standard Edition) i.e. based on Java Programming. Location Tracking System was designed and developed using NetBeans IDE 8.0.2 J2SE (Java 2 Standard Edition), based on Java Programming
- GPS satellite.
- GPS Location server using Google Maps Database.

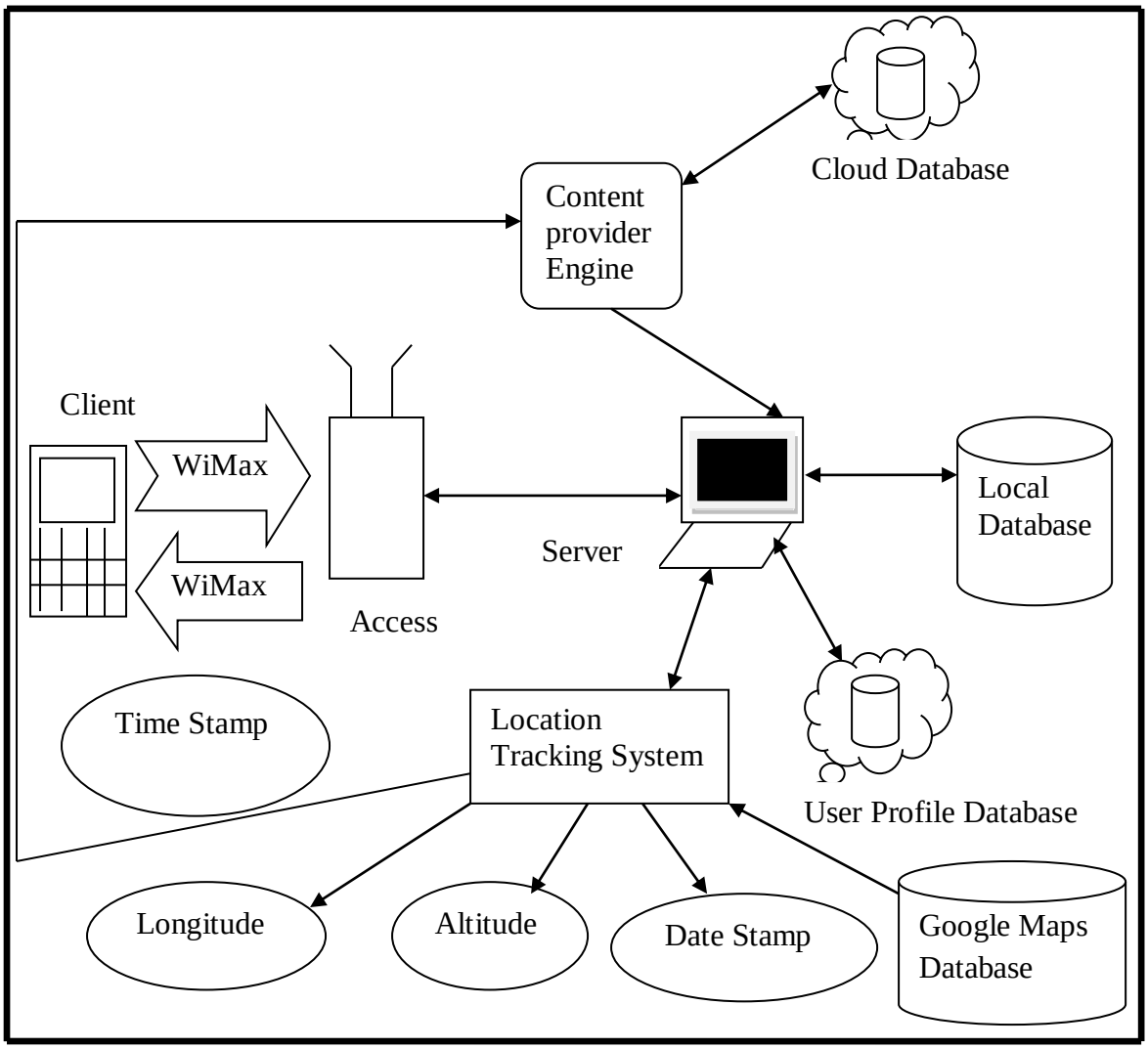

Figure 4.1: LBAML-System Architecture

4. 6 ANALYSIS OF LOCATION BASED ADAPTIVE MOBILE LEARNING MODEL

LBAML model can be analyzed using its Advantages, Benefits, Constraints and Disadvantages [26-27]. LBAML system mainly consists of four components as Client, Server, Location Tracking System and Content Provider Engine.

Advantages

- The LBAML system provides content based on Location information.
- Learners can get updated and advanced curriculum.
- Services are not restricted to four walls of classroom, can be accessed ubiquitously.
- One Material can be used for all states or province of a country, with each states added information
- Highly updated informative competitive examination material can be prepared.

- LBAML system is easy to implement through existing smart phones because which is having in built GPS tracking system.
- Learners reading environment information can be observed or noted continuously using GPS system.
- Working people can get information easily without any time restrictions.
- Database services are efficiently used in system by making use of different databases.
- LBAML system provides better network coverage for learners because of 4G Technology.
- Limited information of the normal m-learning system can be made information rich with the help of location based services.

Benefits

- The LBAML system can be extended to some professional certification program easily which are changes continuously depending on geographical locations
- Students can acquire more knowledge which is updated and relevant to industry requirements.
- Popularity and demand of mobile learning can be improved to great extent.
- Having great ability to acquire new customers because of passionate and dynamic services.
- No time and place restrictions, learners can get services anywhere, anytime.
- Global standard can be maintained in content or material.
- Student Friendly environment
- Student having control over the delivery of content.
- More working people will get benefited.

Constraints

- Lack of new technology
- Maintaining the large repository of data in database and keeping it updated becomes cumbersome process.
- Difficult to apply for professional regular courses.
- Lack of student and teacher one to one interaction or eye contact.
- Monitoring students or learners becomes tedious task.
- Implementation cost is high.

Disadvantages

- Smart mobile phones are feature rich, which can distraction for learners sometime.

- In developing countries like India, lack of network connections in remote places can make non availability of learning resources.
- Device computability issue.
- Very few subjects changes based on geographical location.

4.7 CONCLUSION

M-learning provides great flexibility and freedom for the learners to lean anytime, anywhere, without any restrictions to physical barrier can be extended based on location based information. The learning utilizes different hardware and software technologies and students or learners having complete control over the time limit of the class. In this study we made a conceptual design to provide content based on location based information. Some competitive examination content, especially general knowledge and general awareness changes from state to state, while conducting examination for state government recruited jobs. If we design one standard material and add more information depending on the state where the learners resides, will be more benefited to students. We made an attempt to design a curriculum for this type of scenario.

The Location Based Adaptive Mobile Learning (LBAML) System consists of mainly four components as Client, Server, Location Tracking System and Content Provider Engine. This system makes uses of four databases as local database, Content Provider Engine cloud database, user profile cloud database and Google Maps Database. This paper discusses how in online short term certification courses, changes in curriculum and innovation in teaching, learning and evaluation can be implemented for the benefits for working people located in different geographical regions of the world.

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CHAPTER-5

Changing Perspectives of Mobile Information Communication Technologies towards Customized and Secured Services through 5G & 6G

ABSTRACT

The developments in Information Communication Technology (ICT) made the interpersonal and intra-computer communications ideal in terms of distance and time and made online-ubiquitous communication a reality. Advents in electronic communication technology with an affinity of enhancing the bandwidth and speed through wireless channel supported in development of 3G technologies and further advents in data mining, online analytical techniques further supported in customization of services to the user through 4G technologies at further high speed. In this paper, we discuss the changing perspectives of 4G, 5G and further anticipated 6G wireless technologies. The 4G technology allows downloading speed of 100Mbps and features such as Multi-Media Newspapers, T.V programs with the clarity as to that of an ordinary T.V.The demand of higher security and authentication of users for secured transaction of financial data demanded further development in ICT through 5G technologies. 5G technology also provides inter-working between different technologies like LTE, bluetooth, WiFi, LoWPan and others, to cross layer design in wireless technology. 5G is not a simple evolution of 4G technology and is overall wireless solution and expected to be implemented between 2020 and 2030. This paper also contains the information and discussion on what is the possible 6G in mobile information communication technology? What are its features, functions, benefits and time-scale? Which are the new technologies will support the development of this most anticipated technology which is going to revolutionize the society as most developed civilian society.

Keywords : Advents in communication technology, 4G mobile technology, 5G mobile technology, 6G mobile technology.

5.1 INTRODUCTION

Information and communication technology includes wide range of devices like radio, television, cellular phones, computer hardware, software, network and all applications associated with them such as videoconferencing, teleconferencing, e-commerce and distance learning. The telecommunications industry all over the world has constricted to bring all the services and facilities available to networked computers to mobile devices using advanced wireless communication technologies. 3G technology offers different services to customers like high bandwidth, packet-based transmission of text, voice, video, audio and multimedia needed support through Wide code division multiple access (W-CDMA) and time division-code division multiple access (TD-CDMA). The existence 4G technology is valid testimony for massive and explosive growth of wireless mobile communication technology which is propagated through its predecessors 3G, 2G and 1G [1-2].The main objective4G network is customization of a flexible and ubiquitous service provision enhancing the bandwidth and speed in the middle of 2012 based on digital broadband packet and all IP. 4G technology can be affectively used to provide the customized and ubiquitous knowledge to the learners of distance education students through smart mobile phones. The challenges of 4G wireless networks like 4G global roaming across multiple wireless and mobile networks, accessibility, handoff, coordination of location, wireless security and authentication, network failure and backup and pricing and billing demanded further development in mobile wireless communication technology and gave birth to 5G technologies [3-4]. When 5G is implemented in near future between 2020 and 2030, it is expected that, it will change the world of World Wide Web (WWW) and cell phone with unified global standard, world wide roaming, high bandwidth and all time connectivity.

In this paper, we discuss the challenges in ICT with respect to wireless mobile communication technology, present status of 3G and 4G technology and its changing perspective, overview of future 5G technology and its features and functions, challenges to realize features of 5G technology and ABCD listing of 5G technology. We also discuss further anticipated 6G wireless technology including its overview, expected functions and features, challenges to realize these features, ABCD listing of 6G technology and anticipated time-line of this wire-less ICT Generations.

5. 2 CHALLENGES IN ICT

The challenges of ICT with respect to wireless mobile communication technology are discussed by considering different factors which includes security, backhaul, multiple frequencies, personalization and customization, energy saving, availability and advanced access technology, cost and affordability, global roaming, high performance streaming video.

Security: 4G Provides worldwide interoperability and global roaming between different operators leads to different security challenges. There is need for enhanced and sophisticated security features and mechanism for advanced video streaming and online financial transactions applications.

Backhaul: High bandwidth hungry applications requires maximum amount of data transfer between server and user applications. In order to meet the user's needs ubiquitously, there is a need for update or improvement in existing backhaul or bandwidth capacity by the service providers.

Multiple frequencies: All over the world, 4G LTE network utilizes multiple frequency spectrums. This will arise some problems while switching between different operators in global roaming. As and when mobile wireless communication technology upgrades operators need to add more radio/spectrum other than existing spectrum band in their old or existing spectrum band, which will incur more and cost and complexity.

Personalization and customization: Existing mobile wireless communication technology supports services based on user's requirements or user centric approach. There is a higher need and requirement to users taste and preferences, while considering variety of customer pool with varied interest and liking all over the world.

Energy Saving: A mobile network is formed by three main elements as core network, base stations and mobile terminals. Nearly three fourth of the energy is consumed by base stations compare to energy consumption of whole network. So there is a need for reduction of energy consumptions in base stations and thereby reduce the overall energy consumption of wireless mobile network.

Availability: The existing wireless mobile communication technology having speed of more than 800MHz frequencies can penetrate to any extent with walls and any other solid objectsto ensure wider coverage, still faces problems to reach some rural areas or while moving with very high speed in car or flights.

Advanced Access technologies: The ever demanding services should be accessible by the user all over the world, anywhere, anytime without restriction in terms of location or place

and time or while on move or stationary requires implementation of some sophisticated and advanced access technologies.

Cost and affordability: The mobile service providers should focus more on introducing new tariff plans to attract more customers. Cost and affordability is one of the challenge or hindrance for the usage of new mobile wireless access technologies, especially in some developing and un-developed countries.

Global roaming: User should able to use mobile all over the world, when he is roaming in different countries without any barrier to locations. Even though it is supported in ICT, its facing some challenges or not affectively implemented all over the world.

High performance streaming video: Video content sent through wireless mobile communication technology displayed by the user real time without taking any extra time is not implemented affectively. So there is a need for enhancement or change in this aspect.

5.3 PRESENT STATUS & CHANGING PERSPECTIVES IN ICT

All over the world 3G technologies are affectively implemented by different service providers, which uses universal mobile communication technology (UMTS) by incorporating different range of services, which includes text, voice, video, audio and multimedia needed support. 3G telecommunication services fulfil some of the standard specified by international telecommunication-2000 (IMT-200). The different multimedia service mainly includes video calls and mobile TV.3G technology uses, Wireless Code Division Multiple Access (W-CDMA) radio interface standard, which is most widespread. 3G technology has some advantages over 2G technologies which includes,

- Overcrowding can reduced in existing system with the help of radio spectrum.
- Bandwidth, security, reliability and interoperability between service providers are improved in better scale.
- Availability of services all locations either in urban or rural area are affectively improved.
- Hardware or software system's interfaces and data are compatible with existing networks or supports backward compatibility.
- Packet based IP connectivity helps to improve the devices always online.
- Multimedia services are affectively improved compared to early generations.

3G technology faces some challenges, which are,

- The service providers are faces challenges in building cellular infrastructure and upgrading base stations.

- While upgrading from 2G to 3G technology customer needs new handset is one of the challenge faced by the customers
- While roaming data and voice work together has not been implemented affectively
- More power consumption
- Requires closer base stations in order to increase signal strength is more expensive.

The changing perspective of smart mobile phone users, demanded for high data transfer rate, better real time streaming video and personalised and customised services, which is considered to be foundation requirement for development of 4G mobile wireless communication technologies. With the invention of 4G technology, terminals used for user interfaces also changed from keyboard, display and tablet to new interfaces based on speech, vision, biometrics, touch and soft buttons. International Telecommunication Union-Radio communication Sector (ITU-R) specified set of requirements for the 4G technology which includes remarkable improvement in speed and access technology with speed up to 100 megabits per second (Mbit/s)for high mobility communications and 1gigabits per second (Gbit/s) for low mobility communications. 4G technology is based on all IP-based and uses only packet switching network unlike 3G technology, which uses both circuit and packet switching network. 4G wireless systemsdeliver efficient multimedia services in two types as bursting and streaming video. When user requires real time video, video is played in user's display system without any buffering and delay is called streaming. One of the drawbacks of streaming video is, it does not take the full advantage of high bandwidth and played at a playback rate. Streaming has little memory requirement compared bursting video. While user downloading a file using buffer bursting concept is used at the highest data rate, which utilises full available bandwidth capacity. Virtual presence and virtual navigation are the two greatest applications of 4G technology, which are facilities available to user at all time, even when user is at off-site and can navigate and access database of the LAN, WAN and MAN networks with high speed data transmission rate. 4G has applications in different areas like telemedicine, tele-geoprocessing, crisis management and education [5-6]. Through Telemedicine user gets videoconferencing assistants and consultation of doctor without actually visiting to hospital or clinic. By combining the features of Global Positioning System (GPS) and Geographical Information System (GIS) user can get the particular location by querying through tele-geoprocessing. In all over the world if any natural disaster or calamities occurs, it takes days or weeks to restore the broken down communication system [7-9]. With

the help of 4G technology, it is possible to restore communication system very quickly. 4G technology supports for online education through its ubiquitous or omnipresence nature [10-11]. Table 5.1 and Tabl3 5.3 show ICT generation and Characteristics and ICT generations and applications respectively.

Table 5.1: ICT Generations & Characteristics

S. No.	ICT Generations	Core and Related Technologies	Characteristic Features
1	1 G	AMPS (Advanced Mobile Phone Service)	Supports voice services-Analog Core network is PSTN (Private Switched Telephone Network)
2	1.5 G	CDMA (Code Division Multiple Access)	Analog cellular discontinued Speed-9.2 Kbits/sec Core network is PSTN
3	2.0 G	TDMA (Time division Multiple Access), PDA (Personal Digital Cellular)	PDC & TDMA only supports for one way data transmission Caller ID for calling is supported Not constantly on data connection-just initiated. Technology-1xRTT Core network is PSTN
4	2.5 G	CDMA (Code Division Multiple Access) , GSM (Global System For Mobile Communication)	Digital voice service is first introduced. Speed-128Kbits/sec. Technology-GPRS, EDGE, UMTS Core network is PSTN
5	3.0 G	WCDMA (Wideband Code Division Multiple Access), CDMA-2000, TD-SCDMA(Time division synchronous Code Division Multiple Access)	Excellent voice qualities. Speed-2Mbits/sec in WCDMA, Constantly on data connection. Speed-500-700 Kbits/sec in CDMA-2000 Based on the Interim Standards (95) CDMA standards TD-CDMA Supports broad-band data services (such as multimedia &

			video), Improved roaming Features Core network is packet network
6	4.0 G	IP based packet switching	Speed 40-100 Mbits/sec in mobile Mode and 1Gbits/sec when it is in still. Core Network is internet
7	5.0 G	Unified IP and Seamless combinations of broadband	Speed more than 1Gbits/sec. Core Network is internet.
8	6.0 G	GNSS (Global Navigation Satellite System)	Integrate 5G cellular network and satellite network to provide global coverage. Speed more nearly 10 times more than 5G Core network is internet and satellite communication.

Table 5.2: ICT generations & applications

S. No.	ICT Generations	Applications
1	1 G	Analog voice service
2	1.5 G	Improved analog voice service
3	2.0 G	Digital voice service, SMS (Short Messaging Service) Additional services like fax, data, messaging, and roaming between networks were provided.
4	2.5 G	Digital voice service, SMS (Short Messaging Service), fax, data, and roaming between networks with higher capacity packet.
5	3.0 G	1. Higher bandwidth packet-based transmission of text, voice, video, and multimedia needed to support data-intensive applications. 2. constantly connected to the Internet and have access to a

		consistent set of services worldwide 3. 3G mobile phone can be used as a phone, a computer, a television, a paper, a video conferencing center, a newspaper, a diary, and even a credit card. 4. Anytime anywhere multimedia
6	4.0 G	1.Streaming Video 2.High Level customisation in user end 3.Efficient transmission of video over wireless and bottleneck networks using network coding 4. Global Mobility. 5. High quality video calling. 6. Integrated wireless solution. 7. Ubiquitous service
7	5.0 G	1. Complete wireless communication with almost no limitations 2. Highly supportable to wireless world wide web (WWWW) 3. Multimedia newspaper and watch TV programs with more clarity online. 3. Support for interactive multimedia, voice, streaming vide and internet and other with very good quality 4. Affectively used for Internet of Things (IOT) 5. Efficiently used for cloud computing. 6. Advanced billing applications in mobile systems.
8	6.0 G	1. From the office only one can play or control all home electronic equipments 2. Unimaginable Internet Speed 3. Global roaming even in space and outside of the earth. 4. Customised and personalised service based on what user things in his/her mind. 5. Mind reading Applications.

5.4 5G Technology

Fifth generation mobile wireless technology not yet developed and denotes future of the mobile wireless telecommunication technology. 5G aims to achieve higher capacity than current 4G/IMT-advanced standard in terms of mobile broadband users per area unit, higher speed more than 1Gbit/s and high capacity streaming video. With the help of 5G technology large population of the user can view and play high definition media continuously without any break, many hours in a day with the help of their mobile devices [12-13]. 5G research and development also focuses on improved support on machine to machine communications or internet of things with lower cost per bit, lower battery consumption and more effective in all aspects compare to 4G technology.

5.4. 1 Expected features and Functions of 5G Technologies [14-15]

The next generation mobile network alliance list out some standards for 5G technologies and it defines 5G technology in terms of several features as

- Data rates of tens of megabits per second for tens of thousands or millions of users
- Data rates 100 megabits per second or more for metropolitan areas focusing on more customers
- Speed of more than 1 Gigabits per second simultaneously to many customers on the same office floor.
- Information rate that can be transmitted over specified bandwidth or spectral efficiency will be highly improved compared to 4G technology.
- It can able to provide advanced billing interfaces
- It is going to provide virtual private network.
- Virtual presence and virtual navigation can be highly improved compared to 4G technology specially in multimedia services
- Uploading and downloading speed of 5G technology is going to be improved very much compare to present 3G and 4G technology.
- 5G technology expected to have extra ordinary capacity to support different types of software and hardware interfaces
- Multimedia services with ever seen efficiency any where, any time and anyplace or ubiquitously.
- Expected to provide services without affecting to human health or eco-friendly and environment friendly.

- 5G architecture mainly going to based on nanotechnology, cloud computing and all IP-platform.
- Web standard is expected to Wwww (IpV6)
- Unified IP technology and combinations of broadband, local area network (LAN), wide are network (WAN), personal area network (PAN) and wireless LAN.
- Dynamic information access services and wearable devices with IA capabilities.

Expected Functions of 5G technology are

- User can able to control his/her personal computer by handsets
- Online education will become easier, a student without actually coming to class, can sit anywhere on the world and attend the class.
- A doctor can treat a patient sitting in any part of the world. In simple way 5G technology makes medical treatment easier.
- Internet of Things can be controlled very effectively.
- Possible natural disaster can be easily and effectively detected in advance.
- Any information can reach any part of the world with in seconds.
- Efficiency of weather forecasting can be greatly improved.
- Aircraft system can be affectively improved.

5. 4.2 Challenges to Realize 5G

- Technology is still under process, not yet developed.
- Lack of research in the particular technologies.
- .Lack of standard rules and regulations from standard bodies or authorities.
- Lack of capabilities to supporting massive capacity and massive connectivity.
- Lack of support for increasing diverse and personalized services.
- Lack of Flexibility and availability of all available non-contiguous spectrum for widely different network deployment

5.4.3 ABCD Analysis of 5G

ABCD analysis is a new model to analyse new concepts using its advantages, benefits, constraints and disadvantages. This analysis helps organisation to improve its services or revenue or profit depending on different scenario or with respect to different types of problems [16-17].

(a) Advantages of 5G

- 5G can able to provide advanced billing interfaces for mobile based applications.
- It is going to provide virtual private network for different applications.
- Virtual presence and virtual navigation can be highly improved compared to 4G technology specially in multimedia services
- Uploading and downloading speed of 5G technology is going to be improved very much compare to 3G and 4G technology.
- Through global mobility user can use same mobile set and same SIM and access services in any location of the world.
- Unlike previous generation 5G will allow utilisation of any spectrum and any access technologies for the best deliver of services to the needy customers.
- Extraordinary technology to support any type of services that comes to 5G network line.
- Multimedia streaming video, audio and internet services with ever imaginable or ever seen efficiency.

(b) Benefits of 5G

- Global roaming, user can use services or avail services anywhere of the world anytime.
- User can control home equipments from the office or office equipments from the home without actually visiting to actual locations.
- Availability of any services anywhere, anytime by utilisation of any access technologies or standards.
- Seamless service availability.
- Zero time delay in order to watch video online or ever imaginable quality of streaming video.
- Ever seen improvement in internet speed, audio, video or any multimedia services.
- High quality mobile cloud services.
- Easily upgradable and manageable with previous generation.
- User can control PCs through their mobile phone or handsets.

(c) Constraints of 5G

- Lack of research and new technology
- Complex requirement of more than 10 Gb/s to support mobile cloud services

- Complex requirement of Maximum 10 milliseconds switching time between different radio access technologies in order ensure seamless services.
- Lacks of Global standard or standard authorities are not available as of now.
- Massive or unlimited capacity in supporting number of users for several billion of applications and several billion of systems.
- Requirement to provide eco friendly services.
- Energy consumption should be reduced to large extent or exponential decrease.
- Expected to provide less costly services with high efficiency or quality.
- Expected to provide same speed for any services while on move or in still.
- Lack of technology to support all applications in one platform.

(d) Disadvantages of 5G

- Possible failure of complex requirements.
- Possible failure of new technology due to non acceptability from customers.
- Needs complicated hardware.
- Possible high implementation cost.
- The speed 5G technology claiming is difficult to achieve.
- No global standard or authorities as of now.
- High infrastructure is required at service providers' server side.

5. 5. 1. What is 6G Technology & Why?

6G mobile wireless communication technology or system is future mobile wireless communication technology expected to provide services which is ideal in all standards including seamless access, bandwidth, uploading downloading speed, voice calling, video calling, streaming video and all other multimedia services, integrating satellite communication network. 6G standards are expected to develop by four countries as GPS by USA, Galileo by Europe, COMPASS by China and GLONASS by Russia [18-20]. Due to the following reasons 6G are required;

- Integrating satellite communication system and 5G in order to provide high quality global roaming
- Mobile network should able to read human mind and able to provide services based on what user thinks in his/her mind.

- Due to the human nature of continuous changing requirement and up gradation in existing technology.
- With the expectation to achieve some things, that is considered as ‘never possible’ or not existing as of now.
- High standard and efficiency in internet of things.
- With the requirement of 100% energy saving and reusable or recycling process.
- With the expectation of no limitations in any aspects of mobile communication system.

5. 5.2 Expected Features and Functions of 6G

The next generation mobile network alliance list out some standards for 5G technologies and it list out several features of 6G as;

- Expected data speed of 1000 or 10000 Mbits/sec.
- Internet speed is unimaginable.
- Expectation to use same mobile system even in other globe or in moon or Jupiter using satellite communication system.
- Compatible with any service and access technologies.
- Expectation to provide accurate information about weather forecasting or natural disasters.
- Expected to provide coverage to the entire world with unified, single and global standard.
- User can able to communicate and avail all service anywhere, anytime without physically moving or by sitting in one place.
- Mobile should able to work based on user thinking.
- Absolutely zero latency in accessing or availing services.

Expected Functions of 6G technology are

- One can able to control his intelligent robotic system using his mobile.
- Artificial sensor will be communicating with human mobile system in order to serve based on his/her mind thinking.
- Mobile can communicate with other planet like moon, mars or Jupiter.
- Single Noncore common for all nations and very small billing to end user.
- Communication without utilising any spectrum.
- Expanded and updated data center configuration.

5. 5.3 Challenges to Realize

- Technology is not yet developed and there is no standard specification about the requirements of 6G
- No proper research in the particular technologies and requirement specifications
- No standard rules and regulations from standard bodies or authorities.
- Possible failure to achieve all expected requirements.
- Heavy Infrastructure cost.

5.5.4 ABCD Analysis of 6G

ABCD analysis is used in order to analyse feature expected 6G, which includes four factors as advantages, benefits, constraints and disadvantages. This analysis helps for the development of new technology with some standard requirement or in forming the requirements.

(a) Advantages of 6G

- Intelligent robotic system can be controlled using mobile from any place.
- No limit in access technology, bandwidth, multimedia services and speed similar to supercomputer speed.
- User can able to buy and get any grocery, vegetable or any other items through his mobile without any delay.
- Accurate information about weather forecasting or natural disasters.
- Roaming facility for mobile system not only in earth but also in entire planet.
- Zero delay time in streaming videos.
- Nano technology can be improved efficiently.
- Communication can be possible without utilizing any frequency spectrum.
- Mobile system will communicate with human brain to know human preferences and thinking's.
- Ever seen, ever imaginable growth for cloud computing and Internet of Things.

(b) Benefits of 6G

- User can able to do all activities from a single place.
- User can able to avail all services in a single place or location through his/her mobile device.

- Comfortable and luxurious services.
- Robotic system can be controlled using mobile.
- Sea to space communication can be possible through mobile handset.
- Natural disaster like earthquake, Tsunami can be controlled using 6G.
- Home based ATM can be developed and controlled using mobile handset.
- 6G can be effectively used in space and defence technology for better and quick communication
- Expected to produce energy from other galaxies.
- Like Smart cities, smart home, smart office and smart village can be developed.
- Satellite to satellite communication can be achieved for the faire or good purpose of mankind.

(c) Constraints of 6G

- No proper research and technology in 6G is developed so far.
- Complex requirement becomes very costly and difficult to achieve.
- Multiple standard and multiple requirements as of now and Global standard or standard authorities are not available.
- Requirement to provide eco friendly services.
- Energy wastage should be zero percentage
- Expected to provide less costly services with high efficiency or quality.
- Expected to provide same speed for any services while on move or in still.

(d) Disadvantages of 6G

- Satellite or any advanced communications can be used for diverse disaster applications.
- Possible failure of many requirements.
- Possible failure of new technology due to non acceptability from customers.
- Needs complicated infrastructure including software and hardware.
- The speed 6G technology claiming is may be difficult to achieve.
- No global standard or authorities will result in different requirements by different countries.
- Difficult to implement in under developed and developing countries due to high cost.

5. 6 ANTICIPATED TIME-LINE OF WIRE-LESS ICT GENERATIONS

The time line of ICT generations depends on development of core and related technologies, and their commercialization and acceptance for usage in the society. Based on possible developments of core & related technologies and their penetration to society the anticipated timeline is predicted as is given in Table 5.3

Table 5.3: ICT generations & Time line

S. No.	ICT Generations	Core and Related Technologies	Time line
1	1 G	AMPS (Advanced Mobile Phone Service), Analog Technology, Circuit switching	1981-1985
2	1.5 G	CDMA (Code Division Multiple Access), Analog Technology, Circuit switching	1986-1991
3	2.0 G	TDMA (Time division Multiple Access), PDA (Personal Digital Cellular), Digital Technology, Circuit switching	1992-1995
4	2.5 G	CDMA (Code Division Multiple Access) , GSM (Global System For Mobile Communication), Digital Technology, Circuit switching, packet switching for data transfer	1996-2000
5	3.0 G	WCDMA (Wideband Code Division Multiple Access), CDMA-2000, TD-SCDMA(Time division synchronous Code Division Multiple Access), Circuit switching and packet switching	2001-2011
6	4.0 G	IP based packet switching, IP telephony	2012-2020
7	5.0 G	Unified IP and Seamless combinations of broadband, IP	2020-2030

		broadband	
8	6.0 G	GNSS (Global Navigation Satellite System)	2030 & beyond

5.7 CONCLUSION:

In this paper, we discussed the changing perspectives of 4G, 5G and further anticipated 6G wireless technologies. The 4G technology allows downloading speed of 100Mbps and features such as Multi-Media Newspapers, T.V programs with the clarity as to that of an ordinary T.V. The demand of higher security and authentication of users for secured transaction of financial data demanded further development in ICT through 5G technologies. 5G technologies also provides inter-working between different technologies like LTE, bluetooth, WiFi, LoWPan and others, to cross layer design in wireless technology. 5G is not a simple evolution of 4G technology and is overall wireless solution and expected to be implemented between 2020 and 2030. This paper also contains the information and discussion on what is the possible 6G in mobile information communication technology? What are its features, functions, benefits and time-scale? Which are the new technologies will support the development of this most anticipated technology which is going to revolutionize the society as most developed civilian society. It is expected that the anticipated 5G technology time duration id 2020 to 2030 and 6G technology may prevail in the society beyond 2030 which has characteristics close to Ideal Communication System.

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CHAPTER-6

MASSIVE GROWTH OF BANKING TECHNOLOGY WITH THE AID OF 5G TECHNOLOGIES

ABSTRACT

The advancement in information technology has resulted explosive growth in banking technology like ATMs, internet banking and mobile banking. Banks which emphasis more on existing customer satisfaction and in attracting new customer have implemented online banking and mobile technology to make banking more convenient, attractive and simple. Computerization, wireless network, ATMS, internet banking and mobile banking can connect any customer of any bank in any branch with a customer in any other bank regardless of time, location or physical boundaries. With the widespread of banking technology, public users or customers could create an account from their smart phone without actually visiting to the branch. GoBank is an emerging and new concept of banking without any physical branch, offers mobile bank accounts, especially for smart phone users. 5G (Fifth generation wireless systems) is emerging mobile telecommunication standard beyond 4G in terms of speed, bandwidth, data transfer rate and signaling efficiency. Next Generation Mobile Network Alliance (NGMN) defines 5G with some requirements, which includes data transfer rate more than 1 Gbit/s and should support tens of thousands of users, up to several lacks of connection simultaneously and spectral and signaling efficiency should be more than 4G.

Research and analysis of the new technology helps in popularity of the technology among public users. In this paper we discuss and analyze new banking technology, which includes Digital Deposit Apps, Photo Bill Payment Apps, Smartphone Credit Card Scanners, Electronic Meeting and Mobile Payment Apps. The new technologies are analyzed through a table which includes its advantages, benefits, constraints and disadvantages. Wish this paper could play an active role in actual research of mobile banking technology.

Keywords: Digital Deposit Apps, Photo Bill Payment Apps, Mobile Payment Apps, Electronic Meeting, Smartphone Credit Card Scanners, GoBank.

6.1 INTRODUCTION

The convergence of wireless technologies and the internet is creating a new channel to banking business which inspires the development of value added banking services, the use of smart phones as an access device of banking system functionalities/transactions. With the explosive recent advances in banking technology, customers no longer have to visit a bank branch during normal transactions hours in order to deposit cash, cheque and bill payment or for any other transactions. In 2014 Walmert introduced GoBank for public users or customers to create an account from their smart phone without actually visiting to the branch [1]. Users from home can deposit a cheque and cash can be credited to their account with the help of wireless electronic check deposit scanning and cashing machine [2].

The International Mobile Telecommunications Advanced (IMT-Advanced) specifies any conditions or requirements for 4G, which includes speed of 100 Mbit/s or more while travelling and 1 Gbit/s while stationary, channel bandwidths of 5-20MHz or sometimes even up to 40MHz, all-IP based packet switching network and able to switch over multiple heterogeneous networks simultaneously. 5G (Fifth generation wireless systems) is emerging mobile telecommunication standard beyond 4G in terms of speed, bandwidth, data transfer rate and signaling efficiency. Next Generation Mobile Network Alliance (NGMN) defines 5G with some requirements, which includes data transfer rate more than 1 Gbit/s and should support tens of thousands of users, up to several lacks of connection simultaneously and spectral and signaling efficiency should be more than 4G [3-4].

In this paper, we discuss and analyze new banking technology, which includes Digital Deposit Apps, Photo Bill Payment Apps, Smartphone Credit Card Scanners, Electronic Meeting, Advanced ATM Apps and Mobile Payment Apps. From Digital Deposit Apps using smart mobile phones the cheque is scanned or digital image of the two sides of cheque have taken and sent to the bank for processing it. Photo Bill Payment Apps works by transmitting digital images of a bill to user's account. The Credit Card Scanners will be attached to smart phones will scan and send the digital information for processing. Loan officer or any other officers of the bank can do direct teleconferencing with a user using an electronic meeting with prior request from the user. The Advanced ATM Apps works on the principle of facial biometric recognisition. Mobile Payment Apps helps to make payment for any goods or services. The new technologies are analyzed with its advantages, benefits, constraints and disadvantages.

6.2 Growth of Mobile Communication network from 1st to 5th Generation

Though Internet access is available in most major cities and many rural areas, the Internet connections for many businesses, homes, and schools use relatively slow modem connections through Internet Service Providers (ISPs). Making high-speed (broadband) connections directly available to all locations is the key to realize the true benefits of mobile business applications. A number of existing or future technologies that enable connections between mobile devices and other information appliances and between mobile devices and the Internet are discussed with the help of 1st to 5th generation networks.

A. First-generation (1G) networks: Less often, used than the following terms, 1G denotes the very first generation of common mobile communication networks connectable to the Public Switched Telephone Network (PSTN). These were analog cellular systems such as Advanced Mobile Phone System (AMPS) in the USA, Nordisk Mobiltelefon (NMT) in Scandinavia, or C-Netz in Germany. 1G technology embodied the first realization of cellular concepts, including frequency reuse and handoffs. 1G technology was developed in the year between 1970-1980, which uses analog system and have a speed of about 14.4 kbps by utilizing technologies AMPS, NMT and used for only voice purposes through the phone.

B. Second-generation (2G) networks: GSM (Global System for Mobile Communication) is considered the second-generation (2G) digital network. When data communications are desired, the user must dial-in to maintain a connection. It operates in the 900 MHz and 1,800 MHz frequency bands. Major functional enhancements of 2G technologies are voice coding, digital modulation, and forward error correction. Additional services like fax, data, messaging, and roaming between networks was provided. Especially in the GSM case, the successful Short-Message Systems (SMS) service has shown that voice traffic is not the only service users want. The standardization of the Wireless Application Protocol (WAP) brings the first phones with an integrated browser into the market. These 2nd generation systems had such a wide impact due to the rapid reduction in costs and the perceived quality. In the year between 1990-2000, 2G technology become popular, and have a speed of 9.6-14.4 kbps by utilizing technologies TDMA and CDMA and used by multiple users on a single channel via multiplexing.

C. 2.5G networks: GPRS (General Packet Radio Service) is 2.5G technologies. It is a continuous packet data service, uses the existing network infrastructure, but is being marketed as delivering ISDN-type speeds. Rather than sending a continuous stream of data over a permanent connection, GPRS's packet switching system only uses the network when there is data to be sent.

In between 2001-2004, 2.5 is defined based on Packet data technology with a speed between 20-40 kbps and utilized GPRS technology and through this internet has become popular and data became more popular. By this time phones started supporting web browsing with limited capacity.

D. 2.75G networks: Whereas 2.5G technologies introduce a set of packet-switched functionalities and minor changes of transmission speed only, 2.75G denotes 2.5G technologies with major improvements in transmission speed. EDGE (Enhanced Data GSM Environment), a faster version of GSM, is designed to enable the delivery of multimedia and other broadband applications.

E. Third-generation (3G) networks: UMTS (Universal Mobile Telecommunications System) are the so-called "third-generation (3G)" technology. 3G technology offers different services to customers like high bandwidth, packet-based transmission of text, voice, video, audio and multimedia needed support. The 3G network integrates functions of different range of equipments. There are two major competing schemes for UMTS. Wideband-CDMA (W-CDMA), which is supported by Nokia and Ericsson among others, and time division-code division multiple access (TD-CDMA). W-CDMA is similar to standard CDMA except that it uses higher bandwidth on the transmission channel. 3G technology became popular in between 2004-2005 and which is defined based on digital broadband packet data with a speed of 3.1 Mbps, considered to be the peak, by utilizing technologies like CDMA and UMTS. In 3G technology, multimedia services with streaming became more popular.

F. 3.5 G networks: 3.5 networks developed in between the year 2006-2010, are defined on packet data and have a maximum speed of 14.4 Mbps by utilizing HSPA technology. 3.5G serves the consumer with higher throughput and speed compare to 3G technology.

G. Fourth Generation (4G) networks: Mobile services, applications, and even core network are evolving at high speeds, and distinguishing different generations is not really possible

anymore. The evolution and sometime revolution, is a very significant trend and 4G is such a revolution of air interface rather than a new phase of evolution. 4G technology is characterized by advanced personalization, Industry specific e-process models, Optimized CRM, and Niche customization. E-marketplace is an evolving example of a parallel to a true 4G enterprise business environment. 4G technology provides Web transformation through external automation. The various external automation technologies may involve High optimization, Niche customization, Transparent processes, Self-service, Any –to-any multi-channel integration, Advanced personalization, Voice customer service, E-process driven technology, and Architectural interoperability. 4G networks are introduced with the main intention of customization of a flexible and ubiquitous service provision in the middle of 2012 based on digital broadband packet and all IP very high throughput speed of 100-300 Mbps in peak. Speeds of 4G network are further increased based on data access demand used by various services. Putting the user in the center of the development aims to guarantee a long-lasting, sound and profitable future for 4G.

H. Fifth Generation (5G) networks: Fifth Generation wireless mobile communication can be defined as "a wireless mobile communication technology without any restriction or limitation in terms of bandwidth, speed, access and zone issues. 5G is based on 4G with extended capacity. The 5^{th} generation technology is real wireless communication technology which uses different technologies like LAS-CDMA, OFDM, MC-CDMA, UWB, Network-LMDS and IPv6. When 5G technology is implemented in full-fledged it will change the world of World Wide Web (WWW) and cell phone with unified global standard, high bandwidth and all time connectivity. 5G technology includes all types of advanced features which make it huge, powerful in the near futures. The 5G network is not yet implemented in full swing all over the world. Its throughput speed is expected in the range of gigabytes and going to become popular by the year 2018-2020. It will be going to use available bandwidth efficiently, when it is implemented. Due to the widespread of ubiquitous internet and smart phone services, 5G technology is going to provide tough competition in the marketplace demand or value of normal computers and laptops.

6. 3 SMART PHONE BANKING AND COMMUNICATION TECHNOLOGIES

The influences of wireless telecommunication technologies and the internet have made a drastic revolution in banking transactions and services. Smart phone banking is different from ordinary mobile banking because of some unique, special and innovative features of

smart phones [5]. With the rising complexity in the e-commerce transactions all over the world, different types of electronic payment appeared in the last few years, out of that few payment methods or techniques are in practice or implemented [6]. As younger consumers are more attracted by smart phone, there is more probability to use mobile banking services like fund transfer, balance enquiry, cheque deposit and bill payments due to its convenience and ubiquitous services [7]. Customers can access their bank accounts with the help of fingerprint reader attached to smart mobile phones.

Cellular communications has brought unparalleled, non comparable rapid changes over the fast few years. By using wireless technologies like WAP smart phone devices can be transformed to sophisticated payment devices that can process both micro and macro payments [8]. 5G technology is going to become a new revolution in mobile wireless communications. Through super core architecture 5G will offer very fast mobile commerce or internet or any other services, with unique standard where all network operators will be connected to one single core, even though they differ in their access technologies [9-11]. 5G is a real wireless world with no more limitations in access technology, connectivity, bandwidth or speed and zone issues [12].

This paper focuses on smart phone banking which involves some advanced features that makes banking transactions anywhere, anytime or ubiquitous. It mainly focuses on six services, which are Digital Deposit Apps, Photo Bill Payment Apps, Smartphone Credit Card Scanners, Electronic Meeting, Advanced ATM Apps and Mobile Payment Apps [1].

6.4. 5G ENABLED SMART PHONE BANKING

Fifth Generation (5G) Technology not yet been deployed. 5G is a mobile telecommunication standard beyond 4G in terms of speed, bandwidth, data transfer rate and signaling efficiency. The different components of 5G enabled Smart Phone Banking are Digital Deposit Apps, Photo Bill Payment Apps, Smartphone Credit Card Scanners, Electronic Meeting, Advanced ATM Apps and Mobile Payment Apps as shown in Figure 6.1.

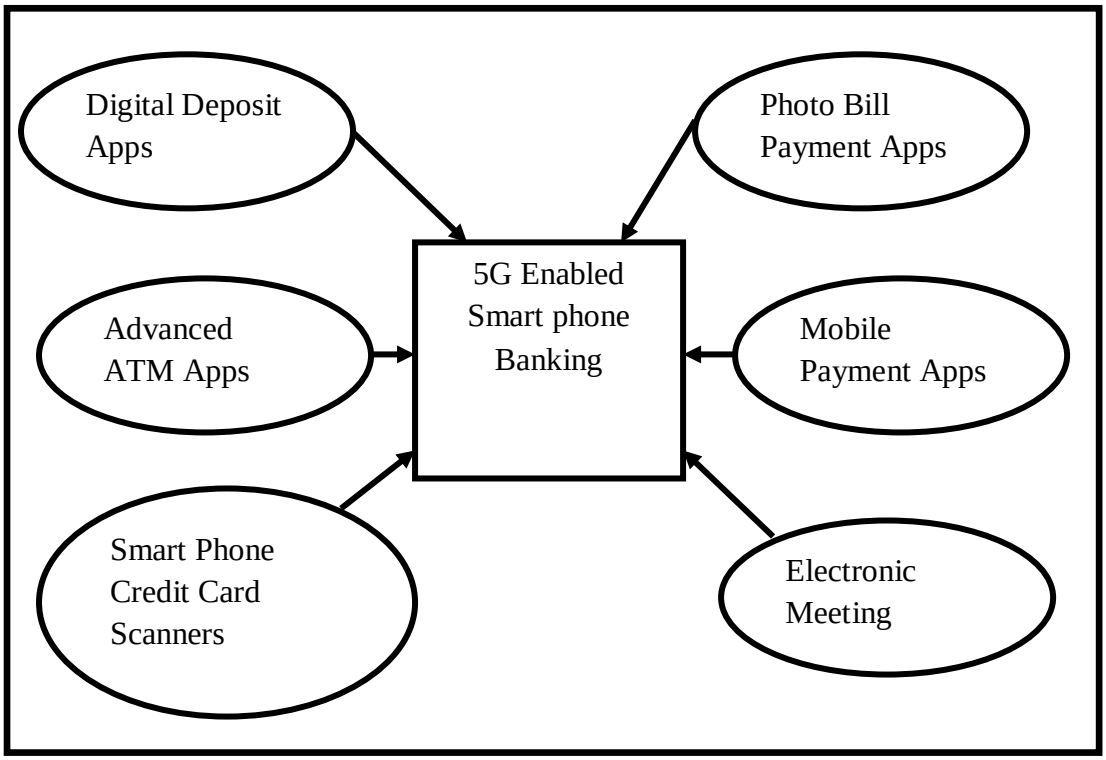

Figure 6.1: 5G Enabled Smart Phone Banking

A. Digital Deposit Apps

Internet technology, wireless mobile communication standards and mobiles Apps made depositing a cheque very simple compared to old fashion paper cheque. In Digital Deposit Apps using Smart Phone users can deposit a cheque and sends two sides of the cheque image or digital scanned image to the bank for processing. In bank cheque will processed as a deposit made by the bank.

B. Photo Bill Payment Apps

In Photo Bill Payment Apps, information's of the bill are transmitted to the respective customer account after taking a digital photograph of the bill. The details of the bill like payment amount, due date and company issuing the bill are collected from the user and bill amount is paid electronically. By setting a proper due date regular bill payment is scheduled using this apps.

C. Smart Phone Credit Card Scanners

Usually credit card is scanned by the scanner or reader owned by the seller. The chances of hacking the password are more in this case. In Smart Phone Credit Card Scanner customer's credit card is scanned by the reader attached to smart phone. The scanner reads the card and specified amount of money is transferred from user's account to payee's account, so that the chance of hacking the password is reduced to an extent.

D. Electronic Meeting

In Electronic Meeting teleconferencing with bank teller or loan officer is a new concept going to be introduced in near future. The customer or user has to take prior permission in order to get an appointment with a bank teller or loan officer. Through this service user can open a new account or can apply for a loan or mortgage.

E. Advanced ATM Apps

In order to retain the existing customer trust and faith and acquire new customers in ATM transactions, banking institutions should incorporate a stronger security mechanism and thereby overcome from fraudulent transactions or users. In this advanced ATM App as soon as the user stands in front of ATM counter, user facial recognition is captured through facial recognition scanning/identification system attached to ATM machines. Facial recognition are sent to bank server and matched against stored facial recognition. If it matches, then an OTP is sent to user's Smart Phone. When users enter OTP in users Apps through wireless communication, OTP is sent to a bank, again matched with already generated OTP, if matches then ATM machine is opened for the user's transaction.

F. Mobile Payment Apps

In Mobile Payment Apps, initially user's credit or debit card information's are loaded into mobile apps. Users might have multiple cards of different banks, all the card information is loaded into mobile apps. Out of multiple choices of card's customer selects any one card from the menu on their Smart Phone and then touches phone to an in-store reader. After this process, payment is processed as like regular credit or debit card transactions.

6.5 ANALYSIS OF 5G ENABLED SMART PHONE BANKING

5G Enabled Smart Phone Banking is analyzed using its advantages, benefits, constraints and disadvantages. Digital Deposit Apps, Photo Bill Payment Apps, Smartphone Credit Card Scanners, Electronic Meeting, Advanced ATM Apps and Mobile Payment Apps six new Smart Phone based banking technologies are studied and analyzed.

Advantages

- Paper less Banking.
- Ubiquitous Transaction facility
- E-slip of the deposited cheque
- Improved Speed, Bandwidth, due to 5G technology
- Automatic bill payment
- Bill payment generates incremental fee revenue
- Smart Phone Credit Card Scanning improves security of customer PIN
- Electronic meeting saves customer time
- In advanced ATMs, difficult to hack/crack the system security
- Improves User Trust over ATM machines
- All bills can be paid without visiting to respective offices
- Easy to use the system, if users are expert in usage of Smart Phone
- 5G Technology makes services more attractive and effective
- Unified standard for wireless communication due to 5G Technology

Benefits

- Global expansion of Smart Phone banking services.
- The ability to obtain a larger customer base due to ubiquitous services.
- The ability to take advantage of the growing popularity of Smart Phone banking through Digital Deposit Apps
- Enhances reputation of the bank by providing fast and secured services to its customer
- Expansion of Smart Phone users
- Banks can able to attract Business people, Software engineers or other tight scheduled customer pool due to their nature of professions.
- Improves consumer reputation of the technology
- High Quality of services are provided due to 5G Technology

Constraints

- Lack of newer technology support
- Possible failure of products due to non-acceptance of customer
- General competitiveness of the banking industry

Disadvantages

- Requirement of high memory and processors at Bank's servers
- Transaction duration time increases.
- Lack of technology support
- Initial investment in technology will be expensive
- Lack of trained staff
- Possibility of misuse of services, especially in electronic meeting
- 5G Technology become more expensive during its initial implementation

6. 6 CONCLUSION

The advanced wireless communication technologies like 5G will offer a variety of services like mobile internet, mobile commerce and bill payment services with ever pleasant, highly sophisticated and super fast nature. The proposed 5G enabled smart phone banking can offer six services- Digital Deposit Apps, Photo Bill Payment Apps, Smartphone Credit Card Scanners, Electronic Meeting, Advanced ATM Apps and Mobile Payment Apps.

In Digital Deposit Apps the cheque is scanned or digital image of the two sides of the cheque has taken and sent to the bank for processing it. In Photo Bill Payment Apps digital images of a bill are transmitted to user's account. The Credit Card Scanners will be attached to smart phones will scan and send the digital information for processing. Loan officer's can do direct teleconferencing with a user using an electronic meeting with prior request from the user. The Advanced ATM Apps works on the principle of facial biometric recognition. Mobile Payment Apps helps to make payment for any goods or services. The proposed 5G enabled smart phone banking having some characteristics like improved speed, bandwidth, improves the security of customer PIN, saves customer time and improves user trust over ATM machines. Wish this paper could play an active role in actual research of mobile banking technology.

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CHAPTER-7

An online comparative study on 4G technologies Service providers in India

ABSTRACT

The rapid development of wireless and communication technology is valid proof for the existence of 4G technology, which is proliferated through its lower generations as 3G, 2G and 1G. The evolution goal of 4G technology lies in high speed multimedia, internet services including on-demand video service, faster web browsing and downloading, which is customized, ubiquitous and flexible services. 5G technology is new generation wireless communication technology with greater services in all aspects and already evolved in some developed countries like U.S.A. In India even though many service providers launched 4G services, that are having some drawbacks like coverage or range only in a few major cities, high cost and problems in speed compared to services provided in western countries. This paper discusses the different service provider's services in terms of some characteristics like frequency spectrum, speed and network coverage etc. This paper analyses 4G services using ABCD analysis techniques based on different applications. Based on the analysis, this paper makes some recommendations to improve the 4G services in India. The widespread growth of 4G technology in India having application in diverse fields like entertainment, education, military and defence and health care. This paper could play active, supportive and a referential role in actual comparisons and research of 4G services in India.

Keywords: 4G, 5G, LTE, ABCD analysis, WiMax

7. 1 INTRODUCTION

Mobile Internet commerce has seen drastic changes over the past few years due to three rapidly growing sectors, mobile, internet and wireless communication technologies. The information and communication Technology (ICT) all over the world has knotted to bring what is available to networked computers to mobile devices using advanced wireless communication technologies like 4G technology [1]. The smart phone now available in the market having the ability to do all the functions that people can do olden days using their personal computers. The introduction of mobile communication technology modernization, innovation and globalization are increasingly driving the banking services to become ubiquitous, personalized, convenience, disseminative and secured. 4G is a fourth generation wireless mobile communication technology succeeding 3G and it should follow the standard specifications specified by International Telecommunication Unit (ITU) in International Mobile Telecommunications-Advanced (IMT-Advanced Standards) with two standards as Mobile WiMax and Long-Term Evolution (LTE) released first in the year of 2007 and 2009 respectively [2-3]. 4G wireless networks challenges in different issues as global roaming across multiple wireless and mobile networks, accessibility, handoff, coordination of location, resource coordination to add new users, support for multicasting, support for quality of service, wireless security and authentication, network failure and backup [4]. 4G is a convergence platform where wide-area (cellular) technology, Wireless metropolitan area network (WMAN) and Wireless local area network (WLAN) coexists together to form an ultra high network which fulfils user variety of services [5]. In India majority of mobile users upgraded their mobile network form 2G to 3G, due to two characteristics speed and no difference in terms of cost. The up gradations from 2G to 3G network can take place without more infrastructure or change in the architecture of the network system. Arshad, M. J. et.al., (2010) presented the detail comparison of the different generations of the mobile communication technologies starting from 1G, 2G, 3G and 4G in a tabular form by considering different factors as speed bandwidth, access technologies, frequency band and network architecture etc, to have an improved knowledge and understanding in the advancement of mobile communication systems [6]

In this paper the status of 4G services in India by different operators are compared and analyzed using different characteristics like bandwidth, speed and network coverage. In India 4G mobile wireless communication technology launched soon after the end of 4G spectrum auction on 19 May 2010. On April 2012 first time in India 4G service is launched by Airtel

through dongles and modems using TD-LTE technology [7]. This paper also tries to give some recommendation for improvement of 4G services in India based on the analysis made in this study.

7.2 PRESENT STATUS AND CHANGING PERSPECTIVE OF 4G TECHNOLOGIES IN INDIA

With the invention of 4G technology, terminals or input device used for user interfaces also changed from keyboard, display and tablet to new interfaces based on speech, vision, biometrics, touch and soft buttons. 4G technology is based on all IP-based and uses only packet switching network unlike 3G technology, which uses both circuit and packet switching network. 4G wireless systems deliver efficient multimedia services in two types as bursting and streaming video. When user requires real time video, video is played in user's display system without any buffering and delay is called streaming. One of the drawbacks of streaming video is, it does not take the full advantage of high bandwidth and played at a playback rate. Streaming has little memory requirement compared bursting video. While user downloading a file using buffer bursting concept is used at the highest data rate, which utilizes full available bandwidth capacity. Virtual presence and virtual navigation are the two greatest applications of 4G technology, which are facilities available to user at all time, even when user is at off-site and can navigate and access database of the LAN, WAN and MAN networks with high speed data transmission rate. 4G has applications in different areas like telemedicine, tele-geoprocessing, crisis management and education. Through Telemedicine user gets videoconferencing assistants and consultation of doctor without actually visiting to hospital or clinic. By combining the features of Global Positioning System (GPS) and Geographical Information System (GIS) user can get the particular location by querying through tele-geoprocessing. In all over the world if any natural disaster or calamities occurs, it takes days or weeks to restore the broken down communication system. With the help of 4G technology, it is possible to restore communication system very quickly. 4G technology supports for online education through its ubiquitous or omnipresence nature. 4G LTE (Long Term Evolution) is fastest mobile wireless technology with download speed up to 100 Mbps. The speed of 4G networks depends on some factors like the devices user going to use the connection, and distance and obstructions or noise between the tower and the receiver. 4G LTE is joint venture by GSM and CDMA vendors to overcome problem of local or multiple standards and to develop single global common standard for mobile communications by

utilizing orthogonal frequency division multiplexing (OFDM) scheme in order tackle issues related to multi in multi out propagation.

Early and in the mid of 2012, Bharathi Airtel was only one service provider, offered 4G services in India, limited to only Kolkata and Bengaluru circle. By the end of 2016, almost all the cities of India will be having coverage of 4G LTE services. At present Indian telecom operators are gearing up to provide better, effective and efficient 4G LTE services around the country. In the race of 4G telecom service providers list Vodafone India and Idea Cellular enrolled them and started providing 4G LTE services in the end of 2015.

7. 3 CHALLENGES OF 4G TECHNOLOGIES

The challenges of 4G wireless mobile communication technology are discussed by considering different factors which includes security, backhaul, multiple frequencies, personalization and customization, energy saving, availability and advanced access technology, cost and affordability, global roaming, high performance streaming video.

Security: 4G Provides worldwide interoperability and global roaming between different operators leads to different security challenges. The nature and vast facilities of 4G network leads to an increased chance of security attacks. There is need for enhanced and sophisticated security features and mechanism for advanced video streaming and online financial transactions applications.

Backhaul: High bandwidth hungry applications requires maximum amount of data transfer between server and user applications. In order to meet the user's needs ubiquitously, there is a need for update or improvement in existing backhaul or bandwidth capacity by the service providers.

Multiple frequencies: All over the world, 4G LTE network utilizes multiple frequency spectrums. This will arise some problems while switching between different operators in global roaming. As and when mobile wireless communication technology upgrades operators need to add more radio/spectrum other than existing spectrum band in their old or existing spectrum band, which will incur more and cost and complexity.

Personalization and customization: 4G supports services based on user's requirements or user centric approach. There is a higher need and requirement to users taste and preferences,

while considering variety of customer pool with varied interest and liking all over the world. 4G technology should meet high level of user expectations in fulfilling user's needs.

Energy Saving: A mobile network is formed by three main elements as core network, base stations and mobile terminals. Nearly three fourth of the energy is consumed by base stations compare to energy consumption of whole network. So there is a need for reduction of energy consumptions in base stations and there by reduce the overall energy consumption of wireless mobile network.

Availability: The existing wireless mobile communication technology having speed of more than 800MHz frequencies can penetrate to any extent with walls and any other solid objects to ensure wider coverage, still faces problems to reach some rural areas or while moving with very high speed in car or flights.

Advanced Access technologies: The ever demanding services should be accessible by the user all over the world, anywhere, anytime without restriction in terms of location or place and time or while on move or stationary requires implementation of some sophisticated and advanced access technologies.

Cost and affordability: The mobile service providers should focus more on introducing new tariff plans to attract more customers. Cost and affordability is one of the challenge or hindrance for the usage of new mobile wireless access technologies, especially in some developing and un-developed countries.

Global roaming: User should able to use mobile all over the world, when he is roaming in different countries without any barrier to locations. Even though it is supported in 4G, its facing some challenges or not affectively implemented all over the world.

High performance streaming video: Video content sent through wireless mobile communication technology displayed by the user real time without taking any extra time is not implemented affectively. So there is a need for enhancement or change in this aspect.

Integrating IP Devices: With the intension to provide better facility and better services with high data transfer rate and high bandwidth 4G technologies should integrate non-IP devices and IP devices. If this feature is effectively implemented, it is possible to integrate infrastructure of all current networks and user can benefited to access services and applications regardless of environment or device independent.

7. 4 PROMINENT 4G SERVICE PROVIDERS IN INDIA

In this study we compare some prominent service providers in India, which includes Airtel, Vodafone Essar, Idea Cellular, Reliance Jio Infocomm Limited, and Aircel. Airtel initially launched 4G services in India in Kolkata through dongle and Modems using TD-LTE technology. Even though, Airtel introduced 4G service in 2012, it introduced 4G services in mobile on 2014 [7]. On 8th of December 2015 Vodafone Essar launched 4G services at Kochi of Kerala state on 1800MHz band [8]. Idea Cellular initially started its 4G services in India on March 2016 across 10 telecom service areas [9]. Reliance Jio Infocomm Limited first launched Beta 4G LTE services to Jio Parterns and its employees on 27th of December 2015 and commercially lunched its services on 5th September of 2016 [10]. Aircel introduced 4G services in India across two states, Tamil Nadu and Jammu and Kashmir on August 2014 [11]. Many other service providers like TataDocomo, BSNL, S-Tel soon planning to launch 4G services in India, but till today not launched in full fledge.

7. 5. TABULAR COMPARISONS OF 4G SERVICES OF DIFFERENT SERVICE PROVIDERS

In Table 7.1, the prominent service provider that we have considered in our study is compared using different features like Speed, Frequency Band and Internet speed [7-11].

Table 7.1: Tabular comparisons of 4G services of different service providers

Service provider	**Launched Year Month and Year**	**Frequency Band**	**Internet Speed**
Airtel	April 2012	1800MHz	25 Mbps
Vodafone	December 2015	1800MHz	6.4 Mbps
Idea	March 2016	1800MHz	12.6 Mbps
Reliance Jio	September 2016	2300 MHz 1800 MHz	5 Mbps
Aircel	August 2014	2300 to 2400 MHz 1800 MHz	4 Mbps

The above table lists only approximate lowest internet downloading speed of different service providers. The speed varies from cities to cities depending on network coverage. High speed

internet, streaming video, multimedia applications and voice calling are few common 4G services provided by almost all operators.

7. 6 ABCD ANALYSIS OF 4G SERVICES BASED ON DIFFERENT APPLICATIONS

ABCD analysis is a new model to analyze new concepts using its advantages, benefits, constraints and disadvantages [13-14]. This analysis helps organization to improve its services or revenue or profit depending on different scenario or with respect to different types of problems. In this analysis we consider different applications of 4G services in diverse fields like Entertainment, Multimedia, Education, cloud based applications, emergence response and telemedicine. In Entertainment 4G services are effectively used for different purposes. Most of the video games require live internet connection with Wi-Fi connectivity mode. 4G portable connection can be used effectively used for this purpose with five to eight different devices. 4G wireless mobile communication technologies provide many features, which can be effectively used to solve some of the challenges in video communications [15]. Using WiMax and LTE, 4G provides streaming video and high speed internet to handle broadcast quality video. With 4G, different applications can use data, software or hardware stored online or owned by others in cloud computing. These services are more reliable, cheaper and effective for the mobile users. Online education portal can be accessed ubiquitously using 4G services [16-17]. In medical applications 4G can be used to make prediction and analyses of different symptoms related to different medical problems or in assisting doctors in remote operations or in teleconferencing.

Advantages:

- Increased graphical support and visual affects for video games
- Effective clear streaming videos
- Fast and live news of different areas, anywhere, anytime and anyplace without any time limit
- Using smart and intelligent networks in 4G user can control some electronic device remotely.
- Online Graphical attractive videos can be played without any time delay with high speed.
- Private and public organisation can grow using 4G technology by reducing cost travelling cost, employee tracking cost.

- Though effective video conferencing a customer can able to communicate with another person situated in any other part of the world.
- A distance education student can avail educational material and content at any time whenever he/she is free.
- A user can get services based on interest, likings, preferences and tastes through 4G personalized and customized services.
- Learns can able to change the curriculum or content in online education by utilizing 4G network.
- The software, hardware or any other resources can be shared or rented in 4G wireless mobile communication by utilizing mobile clod services.
- Learners have control over learning time and content creation.
- Quality of services can be improved highly using advanced access technologies, global roaming, high bandwidth and high data transfer rate.
- Patients can get medical services or consultancies or appointments from their home easily.
- Telemedicine is helpful for junior doctors to avail assistance or help from aged experienced and talented old expert's remote doctors while assisting, while operating patients.
- Through telemedicine and 4G technology hospital services can reach to remote areas, whenever there is a necessity.

Benefits

- A company can improve its revenue and profits through high speed internet connection available with the help of 4G technology.
- Online education system can be effectively improved, because 4G technology is carrier of different services from one part of the world to another part of the world.
- Through 4G technology users can avail some services in their personal mobile device.
- Global or national wide expansion of services, goods and products using fast, high bandwidth and speed 4G technology.
- 4G inherits the growing popularity and standard of smart mobile phones.
- Mobile wireless communication service providers can promote their services along 4G network through scrolling or flash videos.

- Online Education system can grow and improve through omnipresent and speed educational content video with the help of 4G technology.
- The ability to get large customer base or no of customers increases due to ubiquitous nature of 4G technology.
- Online, attractive graphical video game attracts youth customers.
- Cloud computing can work hand to hand and efficiently implement data, software and hardware public services to needy people without any high infrastructure cost or headaches.
- Multimedia and film industries can grow effectively by adopting 4G network in their profession.
- Robotic operation can be affectively implemented by getting assistance from expert doctors living in other parts of the world.
- Medical services can reach to remote places of India with the help of high speed 4G network.
- The problem of mobile portability and global roaming can be solved effectively by utilising 4G technology.
- 4G inbuilt security and authentication facility provides advanced billing services, which will reduce all the burden or hurdles of manual billing system

Constraints

- Lack of research in implementing all features of 4G technology standard specified by ITU.
- The different frequency spectrum usage in different geographical locations leads to difficulties in implementing and managing 4G services for service providers.
- Especially in India, While moving from 3G technology to 4G technology customers have to buy new mobile handset becomes costly and reduces no of customers shifting to 4G technology.
- In India, Lack of new technology to maintain same speed and same bandwidth, when number of customers grows exponentially.
- In India, Government rules and regulation on spectrum band purchase and usage affects 4G service implementation and maintenance.
- Lack of face to face interaction and eye contact between teacher and student in online or e-learning system reduces adopting or using this new education mode in India.

- In India, some rural and undeveloped, uneducated persons region's people finds difficulty in using new technology.
- Lack of trained staff in mobile service providers server side in order to manage 4G services.
- In India even though lot of mobile service providers provides 2G or 3G services, many of them still not launched 4G services, becomes one of the constraint for the popularity or expansion of 4G technology.

Disadvantages

- New frequency for providing 4G services becomes added component in service provider's tower.
- Online attractive and real-time imitative games, even though attracts youth population, the human interaction is reduced while on move in Road and airspace transportation system.
- In India, the high cost of frequency spectrum band becomes one of the hurdles for service providers in launching new generation technology.
- Student's interest and concentration in academic related activities reduces due to availability of attractive games and streaming videos of movies.
- In India, video and voice calling services are finding problems in lower or weak network coverage areas.
- Limited social interaction is one of the problem or hindrance for the development or popularity of online education.
- In India, government has not initiated providing 4G services through their public or owned company like BSNL.
- Portability and file clearing services in 4G technology becomes costly, especially in Indian scenario for ordinary customers.
- For service providers, Initial investment in new technology becomes costly.
- Service providers server side high memory and high end processor becomes costly.
- 4G is presently accessible only convinced and limited cities of India.

7.7. RECOMMENDATION OF THE STUDY

Based on the different prominent 4G services providers services analysis made on this paper, few recommendations are proposed for the development and widespread usage of 4G services in India. The different recommendations are as follows:

- In India, government should start soon 4G services in full fledge through its owned service provider like BSNL.
- There is a need for wide range of research and developments in implementing and maintenance of 4G services, from the government side.
- Network coverage should be improved and available to all parts of the country with equal bandwidth and speed.
- There is a need for initiating or launching 4G services by all the service providers who provides either 2G or 3G services in India.
- In 4G services internet downloading and uploading speed should be improved.
- Government regulations and rules should change in availing and implementing 4G services for service providers.

7. 8 CONCLUSION

The exponential and rapid development of information and communication technology made revolution in mobile wireless communication technology generation form 3G to new 4G and also advances to future upcoming generation, 5G. In India even though many service providers launched 4G services, that are having some drawbacks like coverage or range only in a few major cities, high cost and problems in speed compared to services provided in western countries. In India Airtel initially launched 4G services and now only five to six service providers' offers 4G network. This paper discusses some prominent service providers like Airtel, Vodafone, Idea, Aircel and Reliance Jio 4G service in terms of launched year, frequency band, internet speed in India. This paper also analyses 4G services using ABCD framework with respect Indian service providers and customers. The widespread growth of 4G technology in India having application in diverse fields like entertainment, education, military and defense and health care. Based on the analysis this paper made some recommendation to improve 4G service widespread and improve quality in India.

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