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Submitted in partial fulfillment of requirements for the award
of Bachelor of Technology Degree in Information Technology

By-

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**DEPARTMENT OF INFORMATION TECHNOLOGY
SCHOOL OF COMPUTING**

SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

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SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
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DEPARTMENT OF INFORMATION TECHNOLOGY

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the Bonafide work of **GOKUL KRISSHNA.S** (Reg No: 39120034) who carried out the project entitled “**Mobile Cloud Computing**” under my supervision from October 2021 to November 2021.

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Internal Examiner

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DECLARATION

I, **GOKUL KRISSHNA.S** hereby declare that the project report entitled **Mobile Cloud Computing** done by me under the guidance of **Dr. P.AJITHA** is submitted in partial fulfillment of requirements for the award of Bachelor of Technology Degree in Information Technology.

DATE:

PLACE:

SIGNATURE OF THE CANDIDATE

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ABSTRACT

Mobile Cloud Computing (MCC) is the combination of cloud computing and mobile computing to bring rich computational resources to mobile users, network operators, as well as cloud computing providers. Mobile cloud computing uses cloud computing to deliver applications to mobile devices. These mobile apps can be deployed remotely using speed and flexibility and development tools. Mobile cloud applications can be built or revised quickly using cloud services. They can be delivered to many different devices with different operating systems, computing tasks, and data storage. Thus, users can access applications that could not otherwise be supported. Mobile Cloud Computing is meant to make it possible for rich mobile applications to be executed on a different number of mobile devices. In this technology, data processing, and data storage happen outside of mobile devices. MCC has emerged as a boon to us, it has enhanced battery life, improved data processing and storage capacity, improved reliability and many more, thus in this thesis we dive deeper into understanding mobile cloud computing more deeply, understanding its architecture, its challenges and advantages, how it has been useful to, and to derive conclusions and explore the future of mobile cloud computing.

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LIST OF ABBREVIATIONS

Acronym	Expansion
MCC	Mobile Cloud Computing
BTS	Base transceiver station
AAA	Authentication, Authorization & Accounting
IAAS	Infrastructure as a Service
PAAS	Platform as a Service
SAAS	Software as a Service
AWS	Amazon Web Services
GCP	Google Cloud Platform

CHAPTER 1

INTRODUCTION

Mobile Cloud Computing (MCC) is the combination of cloud computing and mobile computing to bring rich computational resources to mobile users, network operators, as well as cloud computing providers. The ultimate goal of MCC is to enable execution of rich mobile applications on a plethora of mobile devices, with a rich user experience. MCC provides business opportunities for mobile network operators as well as cloud providers. More comprehensively, MCC can be defined as "a rich mobile computing technology that leverages unified elastic resources of varied clouds and network technologies toward unrestricted functionality, storage, and mobility to serve a multitude of mobile devices anywhere, anytime through the channel of Ethernet or Internet regardless of heterogeneous environments and platforms based on the pay-as-you-use principle.

Mobile cloud computing uses cloud computing to deliver applications to mobile devices. These mobile apps can be deployed remotely using speed and flexibility and development tools. Mobile cloud applications can be built or revised quickly using cloud services. They can be delivered to many different devices with different operating systems, computing tasks, and data storage. Thus, users can access applications that could not otherwise be supported.

There are several key features of MCC such as Facilitates the quick development, Shared resources of mobile apps. Supports a variety of development approaches and devices. Improves reliability with information backed up and stored in the cloud. Applications use fewer device resources because they are cloud-supported. Mobile devices are connected to services delivered on an API architecture.



CHAPTER 2

AIM AND SCOPE OF PRESENT INVESTIGATION

2.1 AIM

Mobile Cloud Computing has been a vital assistive technology and its application is significant and widespread, it allows people to access data from anywhere as long as you are connected to internet. You can access the information regardless of the platform you are using, it has brought people closer to information, it has put internet under our fingertips. It is not always possible to have access to desktops and pcs, but with growth of mcc you don't need one to just to check to mails or anything, it is possible through any pocket friendly mobile devices as long it is connected to the internet. It has also increased the space capacity of our devices, as we can save as many photos and documents, we want without worrying about it filling up our phone's memory we can always push it to the cloud, where it is kept safe. You can go real-time with the mobile cloud computing. Since all your data is managed externally, you can access and update your data in real-time on your mobile device. Documents can also be simultaneously

managed by multiple persons. Aim of this investigation is to dive deeper into the technology of mcc, explore its architecture and understand its basic and future works.

2.2 SCOPE

Mobile Cloud Computing, or MCC, merges the fast-growing Cloud Computing Applications market with the ubiquitous smartphone. One of the most ground-breaking blends of modern-day technologies, MCC has proved itself to be highly beneficial to all the mobile users and cloud-based service-providers as well.

In this technique, user-friendly mobile applications are developed, which are powered by and hosted using the cloud computing technology. The '*mobile cloud*' approach enables the apps developers to build applications designed especially for mobile-users, which can be used without being bound to the operating system of the device or its capacity to store data. Here, the tasks of data-processing and data storage are performed outside the mobile devices.

2.2.1 ACCESSIBILITY

Access to mobile cloud computing is super easy, we don't even realize how much we are using mcc in our day to day. The moment we check our social media to the moment we scroll through our favourite shopping website. It all possible because the applications we are using are cloud based. All you need is working mobile devices connected to the internet. It has made every click function in application as many processing is done on the clouds and we can save time as our mobile processors won't be able to process such data. And we want to access the cloud side that is also possible you can develop various applications through the help many platforms like AWS, GCP, Microsoft Azure and many cloud platforms that are available.

2.2.2 APPLICATIONS

There are uncountable applications of mcc, almost everything in our phones is mobile computing based. Mobile cloud computing (MCC) is a technology having lot of applications in monitoring of vehicles, mobile learning, biometry, digital forensic analysis etc. With the help of mobile cloud computing, data processing and storage are performed outside the mobile device and it performed inside the cloud. Here we explore few major applications of MCC.

- **Email.** This is a common example that many people use. Gmail, Outlook, and Yahoo Mail are examples of mobile email. When you check your emails via your mobile phone, you're using mobile cloud technology.
- **Social Media.** Be it via Twitter, Instagram, or Facebook, mobile social networking allows real-time data sharing. For example, a mobile user can store data and share videos with other users.
- **Commerce.** Do you use a banking app or e-shop on your mobile? If the answer is yes, you use mobile cloud computing. MCC in mobile commerce uses scalable processing power.
- **Healthcare.** With mobile healthcare, MCC allows massive amounts of instantaneous data storage in the cloud, accessible via a mobile device. For example, it's quick and easy to access patient records on the go.
- **Dropbox:** Operated by Dropbox Inc., this application is a file-hosting service which offers cloud storage. It lets the users access their files in the 'Dropbox' from their Android devices, which can be synced to other computers or mobile devices.
- **Amazon Cloud Player:** One of the most popular applications on Android platform, Amazon Cloud Player is used to store and play MP3 files. Here the 'Cloud Drive' acts as a hard drive set in the cloud. Users can play their MP3 files

via the web or they can conveniently stream them on their Android devices using Amazon 'Cloud' MP3 application.



CHAPTER 3

ARCHITECTURE, DEVICES AND TECHNOLOGIES USED

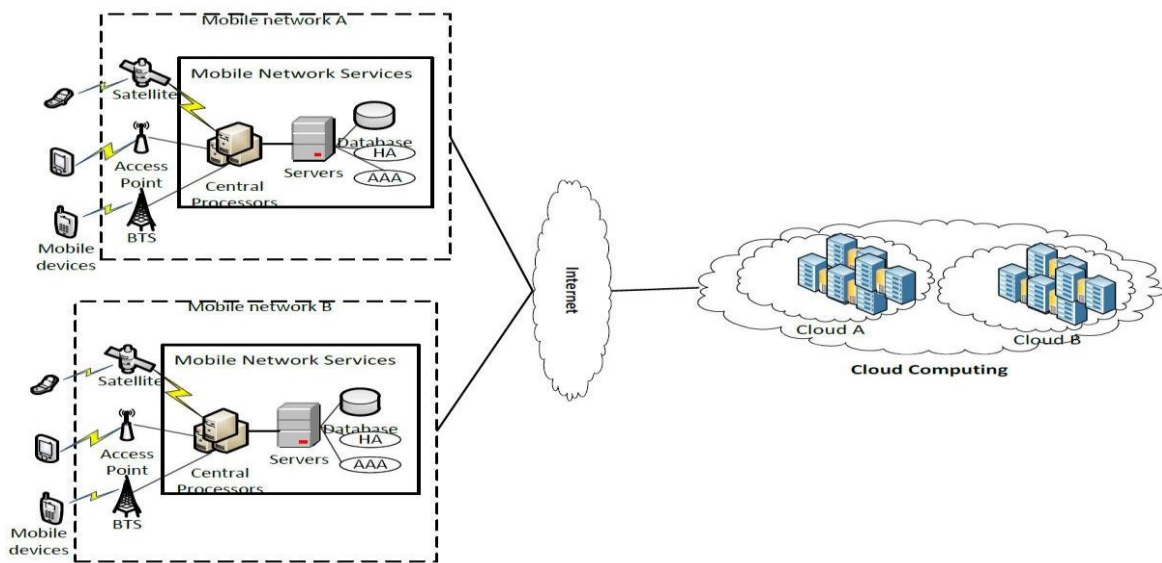
MCC is a mix of both the technologies mobile web and cloud computing. It provides users the necessary software, apps, tools and other resources to access services and applications from cloud on the internet...

There are various parts that make up this architecture.

Clouds take charge of data processing and storage, thus mobile devices do not need to incorporate the power of an advanced processor, huge memory capacity and strength.

Mobile devices are connected to the mobile networks via base stations (e.g., base transceiver station (BTS), access point, or satellite) that establish and control the connections (air links) and functional interfaces between the networks and mobile devices. Mobile users' requests and information (e.g., ID and location) are transmitted to the central processors that are connected to servers providing mobile network services.

Here, mobile network operators can provide services to mobile users as authentication, authorization, and accounting (AAA) based on the home agent and subscribers' data stored in databases. After that, the subscribers' requests are delivered to a cloud through the Internet. In the cloud, cloud controllers process the requests to provide mobile users with the corresponding cloud services. These services are developed with the concepts of utility computing, virtualization, and service-oriented architecture (e.g., web, application, and database servers).



3.1 MOBILE SIDE



3.1.1 MOBILE DEVICES

A mobile device (or handheld computer) is a computer small enough to hold and operate in the hand. Typically, any handheld computer device will have an LCD or OLED flatscreen interface, providing a touchscreen interface with digital buttons and keyboard or physical buttons along with a physical keyboard. Many such devices can connect to the Internet and interconnect with other devices such as car entertainment systems or headsets via Wi-Fi, Bluetooth, cellular networks or near field communication (NFC). Integrated cameras, the ability to place and receive voice and video telephone calls, video games, and Global Positioning System (GPS) capabilities are common. Power is typically provided by a lithium-ion battery. Mobile devices may run mobile operating systems that allow third-party applications to be installed and run. As stated earlier, the most common size of mobile computing device is pocket-sized that can be hand-held, but other sizes for mobile devices exist, too. Mark Weiser, known [by whom?] as the father of ubiquitous computing, computing everywhere, referred to device sizes that are tab-sized, pad and board sized,[2] where tabs are defined as accompanied or wearable centimeter-sized devices e.g., smartphones, phablets and pads are defined as hand-held decimeter-sized devices. These are which connect to mobile networks and further sends request to the cloud.

3.1.2 MOBILE NETWORKS

The mobile phone network enables wireless communication using mobile devices, such as mobile phones, smart phones or tablets. Mobile phone networks provide the necessary infrastructure and are operated by mobile phone providers. In addition to the access network, which establishes the wireless connection to the terminal devices by radio, a core network exists that connects the individual access points to each other. The core network ensures that mobile users can exchange information with those using other access networks or external networks. The main distinguishing factor between fixed and mobile networks is in the access network. The landline network also uses a similar or the same core network, but, as opposed to the mobile network, uses wired technologies in its access network.

3.1.2.1 BASE STATIONS

- A **Base station** transmits and receives user data in the cellular network to customer phones and cellular devices. It is connected to an antenna (or multiple antennas).
- BS is a fixed point of communication for customer cellular phones on a carrier network.
- BSs (Base stations) are company specific. However, one single site may host multiple base stations from competing telecommunication companies.

3.1.2.2 AAA (Authentication, Authorization and Accounting)

Authentication, authorization, and accounting (AAA) is a term for a framework for intelligently controlling access to computer resources, enforcing policies, auditing usage, and providing the information necessary to bill for services. These combined processes are considered important for effective network management and security.

As the first process, authentication provides a way of identifying a user, typically by having the user enter a valid user name and valid password before access is granted.

The process of authentication is based on each user having a unique set of criteria for gaining access. The AAA server compares a user's authentication credentials with other user credentials stored in a database. If the credentials match, the user is granted access to the network. If the credentials are at variance, authentication fails and network access is denied.

Following authentication, a user must gain authorization for doing certain tasks. After logging into a system, for instance, the user may try to issue commands. The authorization process determines whether the user has the authority to issue such commands. Simply put, authorization is the process of enforcing policies: determining what types or qualities of activities, resources, or services a user is permitted. Usually, authorization occurs within the context of authentication. Once you have authenticated a user, they may be authorized for different types of access or activity.

The final plank in the AAA framework is accounting, which measures the resources a user consumes during access. This can include the amount of system time or the amount of data a user has sent and/or received during a session. Accounting is carried out by logging of session statistics and usage information and is used for authorization control, billing, trend analysis, resource utilization, and capacity planning activities.

Authentication, authorization, and accounting services are often provided by a dedicated AAA server, a program that performs these functions. A current standard by which network access servers' interface with the AAA server is the Remote Authentication Dial-In User Service (RADIUS).

3.2 CLOUD SIDE

3.2.1 CLOUD

"The cloud" refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world. By using cloud computing, users and companies do not have to manage

physical servers themselves or run software applications on their own machines. The cloud enables users to access the same files and applications from almost any device, because the computing and storage takes place on servers in a data center, instead of locally on the user device. This is why a user can log in to their Instagram account on a new phone after their old phone breaks and still find their old account in place, with all their photos, videos, and conversation history. It works the same way with cloud email providers like Gmail or Microsoft Office 365, and with cloud storage providers like Dropbox or Google Drive.

3.2.2 LAYERS OF CLOUD

Cloud computing is made up of a variety of layered elements, starting at the most basic physical layer of storage and server infrastructure and working up through the application and network layers. The cloud can be further divided into different implementation models based on whether it's created internally, outsourced or a combination of the two.

3.2.2.1 IAAS (Infrastructure as a Service)

The first is the infrastructure layer that is developed on the virtualization technology where the service providers offer virtual machines as a service to the end-users. It allows the IaaS customers to create and discard virtual machines and networks as per their business requirements. They pay for the services they consumed. IaaS removes the necessity for the consumer to invest on procuring and operating physical servers, data storage systems and other networking resources.

3.2.2.2 PAAS (Platform as a Service)

PaaS is the second layer. Here the customers do not manage the virtual servers but rather create the applications within the programming language. They host the programs on the platform services which they pay for. The management and maintenance of the operating systems and other hardware are done by the providers.

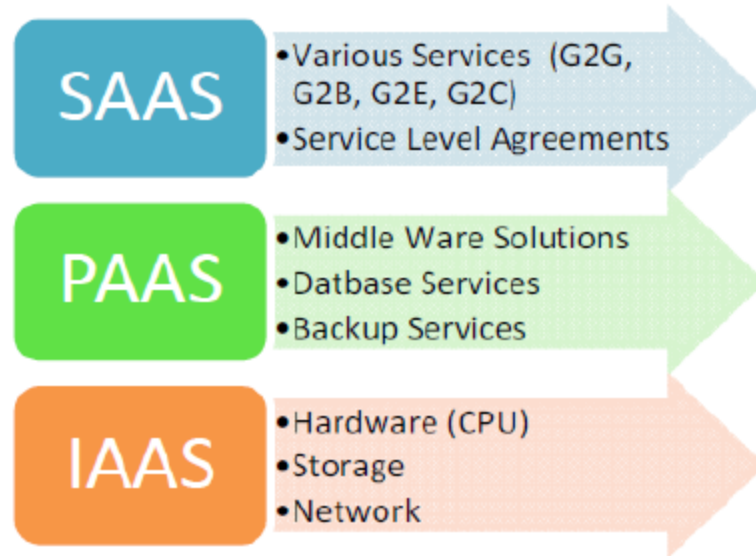
3.2.2.3 SAAS (Software as a Service)

This is the layer of the cloud that is familiar to most people. If you go to a web page and login in order to access a tool or service, you are using SaaS. Some SaaS offerings are free, or at least free for a baseline set of services.

Businesses utilize SaaS on a subscription basis for multiple functions from HR, accounting and payroll, to sales, marketing and project management.

While the core functionality of the application is hosted on the provider's servers, there are some apps that require you to download software to your PC or device to extend capabilities such as synchronization with multiple devices.

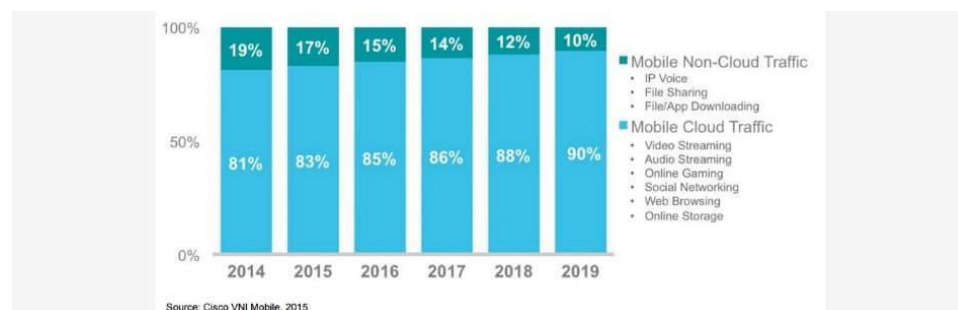
The benefits of SaaS include easy entry and startup. Most apps allow you to add or subtract users as needed so that you are only paying for what you use. The provider takes care of all software upgrades, support and uptime. Many SaaS applications can be integrated with one another to customize their use. For example, your marketing application could integrate with your prospect database, or your procurement application can integrate with your ERP software.



CHAPTER 4

RESULT AND PERFORMANCE ANALYSIS

4.1 RESULT AND DISCUSSION



Graph showing the difference in mobile cloud traffic and non-mobile cloud traffic

The global mobile cloud market is in its evolutionary stage and is exhibiting rapid growth. The global market is expected to grow in the years to come with fast-paced adoption among enterprises. Nowadays, enterprises and consumers are seeking more mobility to remain connected on real-time basis. The continuous development in the

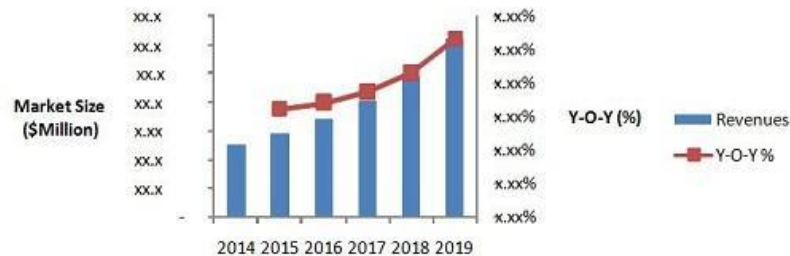
field of mobile has improved business communication by providing connectivity to organizational information on the go. The cloud technology has opened better ways of service delivery and IT usage providing scalability and data synchronization to businesses. The amalgamation of cloud and mobile has further enhanced the term mobility as it provides instantaneous information.

The cloud-based apps are increasingly being used as they shift computational tasks on cloud that enhances the functioning of limited memory mobile devices. The growing multi-purpose usage of Smartphones and improved Internet speed has further encouraged consumers to use cloud-based apps. With the emergence of mobile workforce, enterprises are increasingly adopting mobile cloud, to provide real-time information to employees and enable business continuity, so as to provide an enhanced rich user experience to its customers.

The technological development such as One API, Hypervisor, HTML5, and CSS3 has further bridged the gap for overall interoperability of mobile cloud. Telecom network providers and personal cloud providers have been comprehensively offering extensive amount of cloud services to better serve the rising needs of enterprises and consumers. The usability of mobile cloud market technology is immense among enterprises creating a wide prospect for application developers and cloud service providers.

The adoption of mobile cloud is an imperative growth strategy for businesses that are looking forward to enhance their enterprise mobility. Considering the flexibility, scalability, ease of integration, and data synchronization provided by mobile cloud, users are rapidly adopting it. However, the cloud technology among consumers at times faces the challenges such as lack of awareness, and hence its adoption among consumers is moderate. Besides this, consumers are mostly inclined to adopt free mobile cloud-based apps. In spite of data security still being a major concern, enterprises are significantly the major adopters of mobile cloud technology. Various cloud service provider such as Microsoft, Amazon Web Services, and Google offer cloud services catering to both consumers and enterprises. Further, the personal cloud provider and white-label cloud provider are also adding a significant value to the market.

MarketsandMarkets forecasts the global mobile cloud market to grow from \$9.43 billion in 2014 to \$46.90 billion by 2019, at a CAGR of 37.8% during the forecast period 2014-2019.



Mobile Cloud: Market Size and Growth Rate, 2014-2019 (\$Million, Y-O-Y %)

4.2 ANALYSIS OF THE PROBLEM AND SOLUTION

The MCC whose full meaning is Mobile Cloud Computing term was presented after the idea of cloud computing. Essentially MCC alludes to a framework where both the information stockpiling and the information handling happen outside of the cell phone. Concerning definition, mobile applications move the processing force and capacity from the cell telephones to the Cloud. It might be thought the consolidation of the cloud computing and mobile environment. Furthermore, it has been attracting in the consideration of business visionaries as a beneficial business alternative that diminishes the improvement and running expense of mobile applications and cell clients as another innovation to accomplish rich knowledge of an assortment of mobile services easily, and of analysts as a guaranteeing respond for green center I.T.

There are many reasons to use the cloud computing with mobile technology because modern wireless communication has affected a lot of technological crisis and MCC has able to solve this problem. However, this paper investigates the below difficulty and analysis the proper solution by MCC: a) Process Power or Data Storage Capacity: There are another obstruction is capacity limit of cell phones. Cell phones are by and large had restricted capacity. To beat this issue, MCC might be utilized to get to inquiry

or store the substantial information on the cloud through the remote systems. There are a few samples which are broadly utilized, for example, Amazon Simple Storage Service (Amazon S3) to give the capacity on the cloud. Furthermore, MCC diminishes the time and vitality utilization for machine concentrated applications, which is excessively appropriate when thinking about the restricted resource gadgets. b) Reliability: With the assistance of CC standard, unwavering quality could be enhanced since information and applications are hidden away moved down on a few amounts of machines on the cloud. This gives all the more privately by diminishing the possibility of information misfortune on cell phones. Furthermore, copyrighting advanced substance and avoiding unlawful disseminations like music, feature might be more accessible in this model. Additionally, security administrations like Virus discovery applications could be effortlessly given and utilized as a part of a proficient path without effecting the cell phone execution. Moreover, CC capability, flexibility focal points could be utilized within MCC, too since cloud adaptability is material all in all foundation in the same way. a) Battery Life: Battery life is one of the primary concerns in mobile domain. There are now a few answers for broadening battery life by improving CPU execution, utilizing disk and screen within a proficient way to utilize power utilization. In any case these results are by and large obliging changes in the cell phone's structure or another fitting which means expanding the expense. Reckoning or information offloading strategies are recommended to relocate the enormous and complex reckonings from constrained assets gadgets like cell phones to capable machines like servers in clouds. This abstains from talking a long application execution time on cell phones which bring about vast measure of force and read-compose time utilization. There are numerous assessments to show adequacy of these systems.

CHAPTER 5

FUTURE WORKS

5.1 FUTURE INVESTIGATIONS

a) Privacy: Protection is an essential issue when considering the private information. As the CC period, the same trust issue turns out with the mobile system suppliers and cloud suppliers. They can screen at all the correspondence and information put away in the cloud or system supplier, despite the fact that there is encryption component to grave information imparted or put away. Along these lines, from this prospective, it is a huge headache to be tackled

. b) Communication: The correspondence is formed for various parts from portable supporter of the cloud supplier. Hence there might be a few issues like poor system speed or constrained data transmission. It might be a huge concern in light of the fact that the amount of mobile and cloud clients is significantly increasing.

5.2 CONCLUSIONS

This article has highlighted a far-reaching review of mobile cloud computing. The suitable architecture for mobile cloud computing has additionally been examined so that the readers can have a superior understanding of the mobile cloud computing and its importance. However, some critical and challenges issues also have discussed by this paper and after identify the problems this article also has analyzed the proper solution by the help of Mobile Cloud Computing (MCC) technique. Moreover, this paper also has shown a proper guideline for the future research about the field of Privacy and Communication for Mobile Cloud Computing.

CHAPTER 6

REFERENCES

1. **“A survey of mobile cloud computing: architecture, applications, and approaches”** by Hoang T. Dinh, Chonho Lee, Dusit Niyato Online [Available]: <https://onlinelibrary.wiley.com/doi/abs/10.1002/wcm.1203>
2. **“Analysis for the importance of mobile cloud computing in the field of mobile technology and software management”** by Mohammad Arifin Rahman Khan Online [Available]: <https://www.imedpub.com/articles/analysis-for-the-importance-of-mobile-cloud-computing-in-the-field-of-mobile-technology-and-software-management.pdf>
3. **“The 3 layers that define cloud computing”** by Sam Bloedow Online [Available]: <https://blog.thriveon.net/cloud-computing>
4. M. Klems, A. Lenk, J. Nimis, T. Sandholm, S. Tai. What’s Inside the Cloud? An Architectural Map of the Cloud Landscape. || IEE Explore, pp 23-31, Jun. 2009.
5. **“What is Mobile Cloud Computing”** by kaurbal1698 Online [Available]: <https://www.geeksforgeeks.org/what-is-mobile-cloud-computing/>