Implementation of Client-Side Deduplication of Encrypted Data with Public Auditing in Cloud Storage

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Abstract - Cloud storage is one of popular cloud service model that stores data on the Internet through thecloud computing provider who manages and provides Storage as a service to the end users. Incloud storage huge amount of data will becomes duplicated due to the multiple uploads from thedifferent users for the same data. The cloud servers want to reduce the volume of data stored bythe client which has the similar content and the client wants to maintain the integrity of the data uploaded to the cloud storage. To achieve this there are several models defined using the deduplication and integrity auditing delegation techniques. This project work is to show an implementation of the combining the deduplication algorithm with the data integrity auditing algorithm to achieve the goals of removing the duplication of data and providing the integrity of data to the client. The data considered will be in encryptedformand thehash data isusedto verifythe correctness ofthe data. The proposed algorithm will satisfy the fundamental security requirements and provides an userinterface for the client and the server admin to present the proper management of the data storedon cloud storage. The project work is implemented using the java language on Google drivestorage.

Keywords:Cloudstorage,deduplication,Dataintegrity,Googledrive,Java,Publicauditingalgorithm.

I. INTRODUCTION

Cloud Storage Computing that emerged from a decade is excellent storing platform for manyenterprises IT industries. The Cloud vendors are providing a wide form of services as computing,storage,resourcesandinfrastructuresthroughInternet,withscalablefeaturesforarchivingdatain a cost saving manner. Enterprise IT infrastructure can use the Cloud storage to get on-demandstoragewithnoexpenditureforhardware.TheseCloudserviceprovideraremakingtheEnterprises to have zero maintenance of the archive data. This made the public cloud to have thehuge famous for the Enterprise adoption. As per statistics it is observed that over 93% in 2018from 90% in 2017 of enterprises have started using the public cloud storages. However, there isone issue incloud storageadoption thatis thehidden cost for thetransactions that happensduring the archiving of the data. The enterprise has to pay the additional cost for the duplicationof the data that raises due to the backup process. To avoid this hidden cost the deduplicationtechniqueis used.

1.1 Overview

The most Cloud vendors will charge for the data storage in terms of gigabyte of data.They never identify the duplication of the data that are being stored in terms of gigabytes. Due toexplosive growth in the digital contents rises the demand for new storage and network capacitiesand also the cost effective representation of the huge data in storage and data transmission on thenetwork. Thus, if the data stored are in duplication form, then it will increase the need for moredataspaceand therequirement forthehigher network bandwidth.

The use of network storage system is gaining a broader interest due to its cost effective storageplatforms. These platforms presents the transmission, storage in multisystem environment andhigh computingof outsourced datain a payper usebusinesses.

For saving the resources consumption in terms of both network bandwidth and storage capacitiesmany of the public service providers such as Dropbox, Google and AWS are applying the clientside deduplication techniques. Data deduplication technique in one way for reducing the cost oncloud storage. For example, an

250GB uncompressed data can be stored in 10GB space if wehaveand25%compressionofthedata.Thiscanevenbemoredependinguponthetypeofdatabe backup to the storage. This may save thousands of dollars to the Enterprises that are savinglargedatasets.
Thus it is important that the cloud vendor do the deduplicate data so that there will be cost savingfor the enterprises. An cloud vendor may save the data in compressed form for example, If aclient sends 30 gigabytes of data to the vendor for storage, then the vendor will store that iscompressed for 3gigabytes only. Now the vendor will charge for the 30GB of storage not as3GBofstoragetotheclient.Thustheendusers willnotreceivetheexposuretothededuplicationcapabilities that thecloud serviceproviderareusingin datastorage.
Data deduplication, or"dedupe", is a data compress technique that removes the duplicate information from a dataset before storing in the server. This method will reduces the spacerequirementfor storinglargedatasets inthe cloud servers.
At a top prospective, the deduplication process will work as the function to remove the repeateddata before going to storage. This makes that the server will store only one copy of the data andany other copies will get removed by creating the pointer or reference to the original copy on theplace of requirement. This process will work in transparency for end users and cloud serviceproviders. Looking in deep representation of deduplication, the software will generate an uniqueidentifiers for the data using the cryptographic hash function. The file level will be inefficientbecause the file may get altered during the transmission or during the storage. An single bitchangewill maketheentirefilerestored in thecloud.

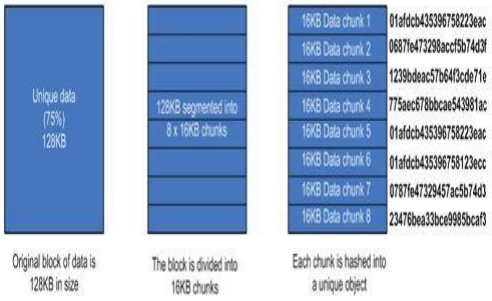


Figure1.1:Hashvalueforuniquedata block.

The deduplication process will normally operate at block-level or even bit-level. In this case thefile will be divided into many blocks of data and an unique identifier is generated for each blockof data. when the file is updated the block that has the changes will be restored as updated ratherthantheentirefile. Thatmeans theblock willgetreplicatedin thefilethanthe entirefile.
The primary storage locationssuch asonpremise data center thatare used for productionworkloads will have thepriority for the performance thatany other activities.Insuch systems,thededuplication process will becometheoverhead forthesystem so itis avoided.
Thededuplicationprocess canbeutilized intwoplaces ofthesystem such as

- At the source or client based deduplication, in which the duplicate data blocks are identifiedand removed before backup process to the defined cloud location. This approach will reducethe bandwidth for the transmission of the data and also the performance overhead for thecloudserver.
- TheTargetorserverbaseddeduplication,thatwillworkastheseparateprocesswhichwillbe monitoring the incoming data for duplication. This need the additional hardware for theservers to perform the operation of removing the duplicate data from the backup servers. Thespecialized hardware can be used to reduce the overhead on server during the large dataset intermsofterabytesprocessing.Thismethodrequireshigherbandwidthforthedatatransmissionsincethe clientwill send allthe datawithoutidentifyingtheduplication.

To verify the integrity of files that backup, clients need to perform another complex operationwhich is called public auditing, whose complexity increases in proportionto the size of data.This process will check the correctness of the data stored by the client and provides the reason ofchange.

1.2 Motivation

ThemostpopularcloudservicesoftodaysareAmazonandGooglewhoareprovidingthe public services for the cloud storage and are used by many individuals and business forvarious applications. These services are seeing the dramatic evolution in network techniquesalong with the huge volume of data generation and getting stored on archive storages servers. Asexample, the 5G networking technology showing thegigabits of data transmitted per second.This means the size of data to be dealt by cloud storage services is increasing due to the newnetworking technique and they are demanding on the performance of the data storage in thesecloudservices.

Looking at this viewpoint, the characterizing the volume of data generated by the client and sentto the cloud servers is an important feature. Many service providers have already prepared to usethe faster networks for transferring the high resolution contents through their service. In new erathere is huge demand for the secure cloud services which need to important in preparation ofsuitable security tools for adopting in large volumes. The large volumes of data demands forhigher cost for managing in different aspects. Thus the size of data directly influences the cost on the cloud storage. To scale this storage cost it is required t o reduce the size using some algorithms.

Thus, it is required for storage servers to reduce the volume of data which automatically cut thecost of maintenance. On the other side the client also interested in the integrity of the data that isstored on the cloudstorageand the service provider's hastoprovide the proof of correctnessinthestorageofclientdata.Theseissuesmotivatedtoforthedevelopmentofancombinedalgorithmof deduplication with dataintegrity.

1.3 Objectives

Theprimaryobjectiveofthisproject workdefines thefollowingobjectives

- Privacy:Toimplementthededuplicationofdatawherethedataisencryptedbeforestoringonto theserveranddecrypted when the useraccess thedata fromserver.
- Verifiability by the end user: The end user can check the stored data with the assist of theTPA. The TPA is able to examine the accuracy and check the data availability without seeingtheentiredataand without intervention bythe data owner.
- Correctness of storage: If the CSS is keeping the user's data intact, then the TPA verificationwillget passedforeverychecks byclient

The project will involve with the following types of attacker models: outside attackers, insider inCSS,and semi-honest attackers inTPA.

- Outside attackers: If the communication channel is not secure then an outside attackers caneasily intercept the data transmitted. These attackers attempt to pass the PoW process as ofthedata owner and steal thedata in confidential.
- Insider in CSS: An insider of CSS may make the malicious attacks on the data. They mayattempt to manipulate the user's encrypted data and perform the update or delete of the user'sdata.Theseattacks mustbeblocked bythe CSS toavoid the insider attack.
- Semi-honestTPA:Itisan trusted module between the data owner and CSS. Itisassumedthat the TPA is performing the protocol correctly, but the semi-honest TPA may attempt toextractall thesensitiveinformation duringthevalidation ofthe user request.

1.4 Statementabouttheproblem

The project work is considers the two primary issues. Firstly, the security for data on doing thededuplication of data by data owner. Secondly, auditing for the integrity of the data by the dataowner.Thesearefundamentaloperationsrequiredincloudservicesforstorage.Hence,individual researches are conducted based on these two issues. However, only few studies areconductedfor combinedschemetosupport deduplicationand dataintegrityverification.

The fundamental design solution highlighted in this project work is to define an combined modelof deduplication with encryption technique and third party auditing for verifying the integrity ofthedatatowillhavelessoverheadinthecombinedalgorithm.Inparticular,toshowtheimprovementin the cost of computationand communication.

1.5 ProposedSystem

In this project, a new scheme is designed which is secure and efficient for the storing of data oncloud storage service. The scheme supports both secure deduplication and integrity auditing in acloud data . In particular, the proposed scheme provides secure deduplication of encrypted data.The proposed scheme also supports public auditing using a TPA (Third Party Auditor) to helplow-powered clients. The proposed scheme satisfies all fundamental security requirements. It isefficientcompared toexistingschemes.

1.6 Scope

The scope of this project work will reflects on the following technology and it is broadening incloudsystems.

1.7 *PrimaryStorage*

Reduced capacity requirement for the storage data. Deduplication technique defined willbe used in archive applications. This is a promised solution for saving the space on server filesystem.

1.8 Replication

Deduplicationandreplicationprocedureswillworkconcurrently.Thereplicationprocedure before initiating the data duplication will examine the data deduplication information.Thusthis project work willdirectlyhelpful in

enhancingthe replication procedure.

DataProtection

This work will influence the implementation of data protection methods. The settings ofdata deduplication on are a technique that is mainly used for reducing the redundant data in thestoragesystem which will unnecessarilyuse morebandwidth andnetwork.

Archrivals

Data deduplication system implemented will inspect data down to block and bit level.After the initial inspection, only the changed data will be saved, while the rest is discarded andreplacedwith a pointertothe previouslysaved information.

MovementandMigrationof Data

The primary characteristics of data movement and data migration service are to transferthe data in a faster and accurate way. The data deduplication method will reduce the data sizeswhichwillinternallyincreases the speed of transfer of data.

The improvement in this algorithm is that it is having two variations to provide higher securityand better performance. In the first variance, this is designed for stronger security. The systemassumesastrongeradversaryandprovidesacountermeasureagainsttheattackers.Thesecond,isthat it supports lostpoweredclient to do uploadoperation.

1.9 Methodology

The system uses the BLS signature-based Homomorphic Linear Authenticator (HLA),which was proposed in [1], for integrity auditing and secure deduplication. The proposed schemeconsistsof thefollowingentities.

Client(ordataowner).

Sendsthedatatocloudstorage.CE-encrypteddataisfirstgenerated,andthenuploadedtothecloudstoragetoprotect confidentiality.Theclient alsoneeds toverifytheintegrityof thedata.

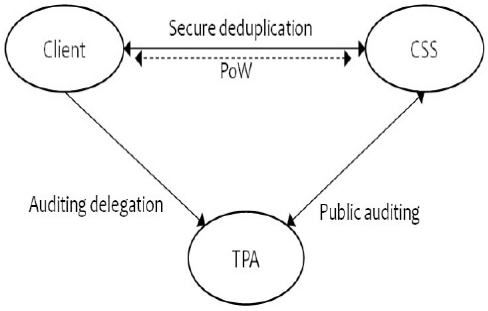
CloudStorageServer(CSS).

Provides data storage services to users. Deduplication technology is applied to save storage spaceandcost.IntheprojectitisassumedthattheCSSmayactmaliciouslyduetoinsider/outsiderattacks,software/hard waremalfunctions,intentionalsavingofcomputationalresources,etc.

TPA(ThirdPartyAuditor).

Performs integrity auditing on behalf of the client toreduce the client's processing cost. Insteadof the client, the auditor sends a challenge to the storage server to periodically perform anintegrityauditprotocol.Therelationbetweenentitiescanbeseeninfigure1.2.AclientandaCSS perform PoW for secure deduplication, and a TPA is placed between the client and the CSStoexecute integrityauditinginstead of theclient.

Fig1.2:Proposedsystemarchitecture.



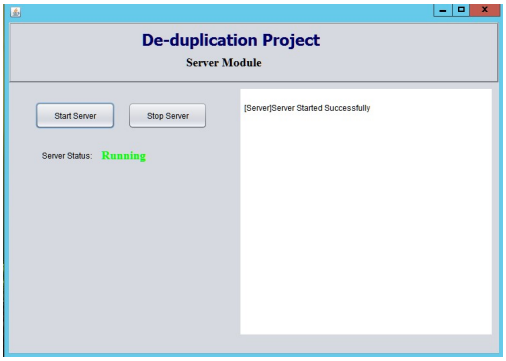
1.10 Contribution oftheproject

The project work defines two improvements to the implementation of the deduplication andpublicaudittechniques.Thetwovariationsaretoprovidehighersecurityandbetterperformance.The system is designed to provide the stronger security by using the privacy and encryptionalgorithms and to support the low powered client to upload their data to the cloud with anyoverheadof thesystem.

1.8 ExperimentalResults

CloudStorageServer

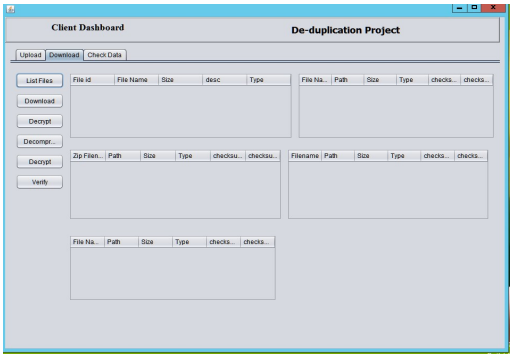
The deduplication project has the dedicated cloud storage server which manages thestoring of the user's files into the cloud storage. The figure 1.3Figure1.3:Cloudstorageserverstatusmodule.
show thegraphical user interfacecreated for the server module. The will listen for the user request for the file



storage. To start theserverstart server button is clicked.

Figure 1.4 shows the running for the cloud storage server which will start its execution on the port 5000and waits for the client request. When the client requests for the transfer of file, the server will establishtheconnection withthe Googledrive andstores the fileinto theGoogle drive.

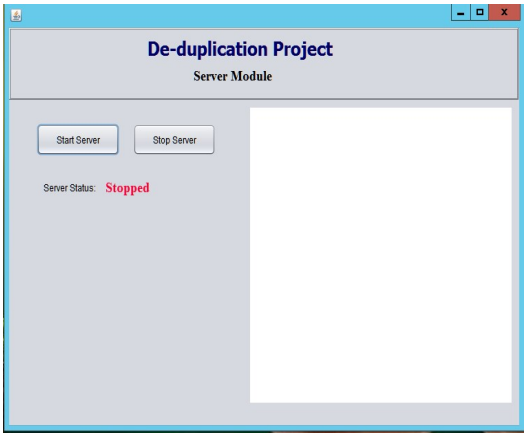
Figure1.4:Cloudstorageserverrunningstatus.



5.1 UserModule

Theuserwillstartswithlogincredentials.theusermodulewillhavetheoptionstoupload the file to the cloud, download the file from the cloud and verify the integrity of the filepresent in the cloud. figure 1.5 shows the clients dashboard where the interaction of the user withthe system is implemented.Each user will go with the corresponding options for performing theneedprocedureexecution.

Figure1.5:Userdashboardfortheinteraction.



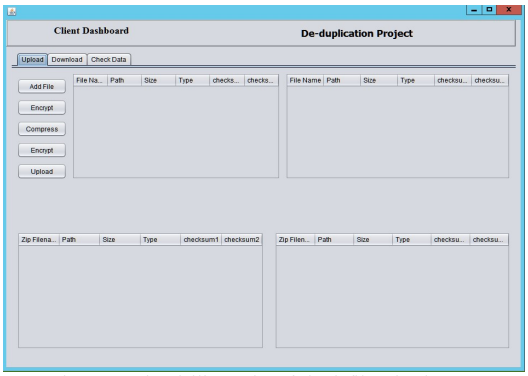


Figure1.6:Simpleillustrationof singlefileupload.

The file upload operation is shown in the figure 1.6. The user will select the needed file to uploadto the cloud. Here the user can select multiple files for the upload. The files will get encryptedusing the AES 256 algorithm, then the content will get compressed into a single file. The singlezip file will be encrypted again. The final encrypted file will be sent to the cloud server for thestorage.

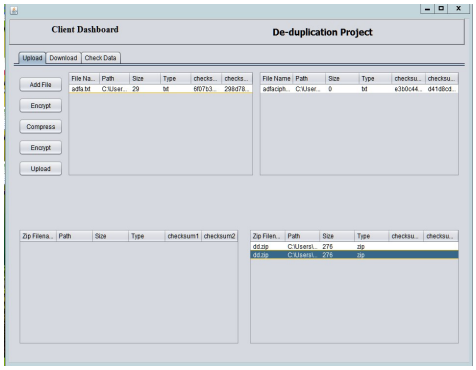


Figure1.7:Simpledownloadoptionsforclientfrom CSS.

Thestoredfilesoftheusercanbedownloadedbyusingthedownloadoptionasshowninfigure 1.7.Theuserwilllistthefilesthatareuploadedtothecloudbytheclient.Thentheuserselecttheneededfileforthedownlo ad.Thedownloadedfilewillfirstgetdecryptedandthendecompressed. The files that are downloaded will again get decrypted to its original file. Thisprocess is illustrated as shown in the figure 1.8. The figure 1.9 shows the file stored on theGoogledriveafter theupload operation.

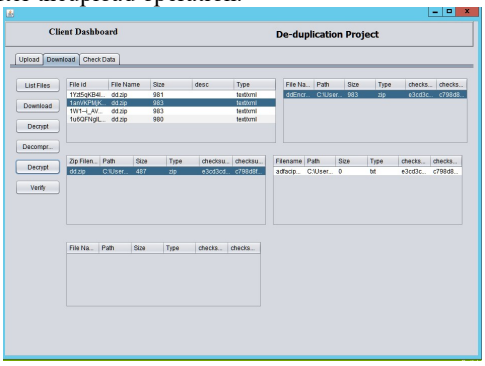


Figure1.8: Filedownloadprocessbyclient fromCSS.

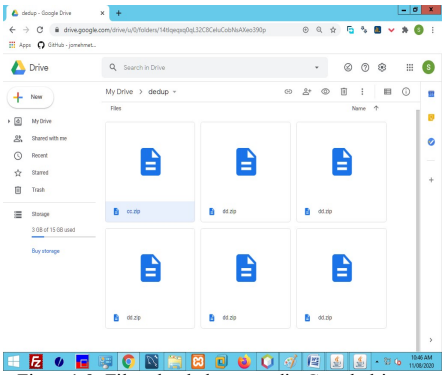


Figure1.9: Fileuploadedgotstoredin Googledrive.

1.11 Conclusion

ConclusionandFuture Works

EmergingCloudcomputingand5Gtechnologiesaregivingthemoredatastoragerequirements for the cloud storage service providers. The cloud storages are used more than everin the past decade. Managing the storage in an cost effective manner is the primary issue for thecloud storage service providers. This work extends the existing Cloud framework by addingfeatures to cloud storage providers and users. The Deduplication architecture discussed in thiswork provides a single file system with the traditional sharing and improves on the resourceconsolidationand scalableperformance.

Throughthisprojectwork,animplementationofsimplededuplicationstoragearchitectureisdemonstratedthroughw hichshowsthattheunstructureddatafilescanbeencapsulated with an object along with the meta information. The verification of the stored dataoncloud can beaccomplished usingthe TPA module.

FutureWork

The project is developed using the basic ideas of the file object construction, file objectserialization,andfileobjecttransmissiononthenetworksockets.Thisimplementationcanfurther developed to include all the necessary features of file storage representation. The metadata collection and representation can be further improved. The project work is demonstratingonly the unstructured data file upload and download. It can be enhanced to show the objectrepresentation for the folders and incorporating the folders as the files into the cloud storage. Thesecurity mechanism implemented in the project is only confined to the authentication of the userandadministrator.

REFERENCES

[1] Ibrahim AbakerTarigo Hashem “The Rise of Big data on cloud Computing: Review andopenresearch issues”, 2014 Elsevier.

[2] PrenticeHall“UnstructuredTextualdataintheorganization”,Research Paper.

[3] Gollmann.D, ComputerSecurity,2nd Edition,JohnWileyand Sons, 2005.

[4] Q. Wang, C. Wang, J. Li, K. Ren, and W. Lou, “Enabling public verifiability and datadynamics for storage security in cloud computing,” in Proc. of ESORICS’09, volume 5789 ofLNCS.Springer-Verlag,Sep. 2009, pp. 355–370.

[5] CongWang,ShermanSMChow,QianWang,KuiRen,andWenjingLou.PrivacyPreservingPublicAuditingforSecureCloudStorage. http://eprint.iacr.org/2009/579.pdf.

[6] CongWang,ShermanSMChow,QianWang,KuiRen,andWenjingLou.PrivacyPreservingPublicAuditingforSecureCloudStorage.Computers,IEEETransactionson,62(2):362–375,2013.

[7] CongWang,QianWang,KuiRen,NingCao,andWenjingLou.Towardsecureanddependable storage services in cloud computing. Services Computing, IEEE Transactions on,5(2):220–232,2012.

[8] Cong Wang, Qian Wang, Kui Ren, and Wenjing Lou. Privacy-Preserving Public Auditing forData Storage Security in Cloud Computing. In INFOCOM, 2010 Proceedings IEEE, pages 1–9.IEEE,2010.

[9] Qian Wang, Cong Wang, Kui Ren, Wenjing Lou, and Jin Li. Enabling Public Auditabilityand Data Dynamics for Storage Security in Cloud Computing. Parallel and Distributed Systems,IEEETransactions on, 22(5):847–859, 2011.

[10] Solomon GuadieWorku, Chunxiang Xu, Jining Zhao, and Xiaohu He. Secure and efficientprivacy-preservingpublicauditingschemeforcloudstorage.Computers&ElectricalEngineering,40(5):1703–1713, 2014.

[11] IK Meenakshi and Sudha George. Cloud Server Storage Security using TPA.InternationalJournal of Advanced Research in Computer Science & Technology (IJARCST) ISSN: 2347-9817,2014.

[12] Kim, K., Youn T.Y., Jho N S, and Chang K. Y., (2017), “Client-Side Deduplication toEnhanceSecurityandReduceCommunicationCosts”,ETRIJournal,39:116-123.doi:10.4218/etrij.17.0116.0039[13] P.Puzio,R.Molva,M.ÖnenandS.Loureiro,"ClouDedup:SecureDeduplicationwithEncryptedDataforCloudStorage," 2013IEEE5thInternationalConferenceonCloudComputingTechnologyandScience,Bristol,2013,pp.363-370,doi:10.1109/CloudCom.2013.54.

[13] Mr.Chethan Chandra s basavaraddi,“Performance Evaluation Of Mesh And PositionBasedHybridRoutingInMANETs”,IrnetInternationalConferenceOnComputerScienceandEngineering(ICCSE)-February3rd,2012-Nagpur,ISBN-978-93-81693-17-9.

[14] Mr.ChethanChandrasbasavaraddi,"CurrentProjectWorkonRoutingProtocolsForMANET:ALiteratureSurvey",IrnetInternationalConferenceOnComputerScienceandInformatics(ICCSI)-March 9th, 2012-Hyderabad, ISBN-978-93-81693-25-4.
[15] Mr.Chethan Chandra S Basavaraddi," A New Routing Algorithm in MANETS:Location Aided HybridRouting", Chethan Chandra S Basavaraddi et al,Int.J.ComputerTechnology&Applications,Vol 3(2), 760-765760 ISSN:2229-6093.
[16] ChethanChandraSBasavaraddi, "PerformanceAnalysisofMeshandPositionBased Hybrid Routing In MANETS: A Comprehensive Study", Chethan Chandra SBasavaraddi et al ,Int.J.Computer Technology &Applications,Vol 3 (2), 804-812 804ISSN:2229-6093.
[17] Mr.ChethanChandra SBasavaraddi, "A ComparativeAnalysisOf TwoPositionBasedHybridRoutingAlgorithmsOverMANETs",/InternationalJournalOfComputational Engineering Research / ISSN: 2250–3005 IJCER | Mar-Apr 2012 | Vol. 2 | IssueNo.2 |540-546 Page540.

[18] Mr. Chethan Chandra S Basavaraddi, "Current Project Work On Routing Protocolsfor MANET: A Literature Survey", International Journal of Scientific and EngineeringResearch (IJSER)-Volume3, Issue5, May2012(ISSN 2229-5518).

[19] Mr.ChethanChandraSBasavaraddi,"PerformanceEvaluationOfMeshAndPosition Based Hybrid Routing In MANETs", International Journal of Scientific andEngineeringResearch(IJSER)-Volume3, Issue5, May2012 (ISSN2229-5518).

[20] Mr.ChethanChandraSBasavaraddi,."AComparativePerformanceAnalysisOfTwoPositionBasedHybridRoutingAlgorithmsUnderMobilitySpeedOverManets","InternationalConferenceOnRecentTrendsInComputerScienceAndEngg.(Icrtcse 2012) held at May 3rd & 4th 2012. Apollo Engineering College Sriperumbudur,Kanchipuram– 602105. Tamil Nadu, South India.
[21] Mr. Chethan Chandra S Basavaraddi," A Stable Route Selection in PBHRA forMANETs",National conferenceAdvancesinElectronics & communicationTechnology(NCAECT2012)May18th,2012.DeptofStudiesandResearchinElectronicsKuvempu University,Shankaraghatta-577451 ShimogaDist, Karnataka.
[22] Mr.ChethanChandraSBasavaraddi,"APBHRAINMANETs","Nationalconference on Emerging Mobile Technologies And Policies (NCEMTP-2012) 28th May 2012to30th May2012.OrganizedbyDepartmentofTelecommunicationEngineering,M.S.RAMAIAHINSTITUTEOFTECNOLOGY, Bangalore-560054.
[23] Mr. Chethan Chandra S Basavaraddi, "A Comparative Analysis Of Two PositionBasedHybridRoutingAlgorithmsUnderMobilitySpeedOverMANETs",InternationalJournalofResearchandInnovationinComputerEngineering,ISSN2249-6580,Vol 2, Issue3, June2012, (285-291).
[24] Mr.ChethanChandraSBasavaraddi,"MANETsApplicationonEnvironment",UGC sponsored National conference on Perspectives of PhysicsinReducingEnvironmentalPollution,KalpataruFirstGradeScienceCollege,Feb2014,Tiptur-572002.
[25] [26]Mr.Chethan Chandra S Basavaraddi, "How hard is English – Kannada MachineTranslation",InternationalseminaronComputationallinguisticsonIndianLanguages,heldbyCDAC,IIIT-Trivandrum&Keralauniversity,Thrivandrum,feb-2014.
[26] [27]Mr.Chethan Chandra S Basavaraddi, "A Typical Machine Translation System forEnglish to Kannada", International Journal of Scientific & Engineering Research, Volume5, Issue4, April-2014, ISSN 2229-5518.
[27] [28]Mr.Chethan Chandra S Basavaraddi, "Current Project Work on English toKannadaMachineTranslationSystem:aLiteratureSurveyonNLP",Int.J.ComputerTechnology&Applications,Vol 5(3),1254-1275,2014.
[28] [29]Mr.Chethan Chandra S Basavaraddi, "Simultaneous Prediction of Stock MarketInvestmentsby AnalyzingSentiments:A SupervisedJoint AspectModel",NCETSE2018.
[29] [30]Chethan Chandra S Basavaraddi, "Privacy policy controlling for OSN users"ISSN(Online): 2347-2820, Volume -4, Issue-8, 2016, International Journal of Electrical, ElectronicsandComputer Systems (IJEECS).
[30] [31]ChethanChandraSBasavaraddi,"SingleHopCryptographicServerBasedDataSharing in Cloud" ISSN (Online): 2347-2820, Volume -4, Issue-8, 2016, International JournalofElectrical, Electronicsand Computer Systems (IJEECS).
[31] [32]ChethanChandraSBasavaraddi,"FaceRecognitionUsingHybridNeuroFuzzyNetwork for Occluded Images", International Journal of Science and Research (IJSR), ISSN:2319-7064,ResearchGateImpact Factor (2018):0.28 | SJIF(2019):7.583.
[32] ChethanChandraSBasavaraddi,"FaceRecognitionfromFeedForwardNeuralNetworkforOccludedImagesUsingHybridNeuroFuzzyNetwork",Internationalconference on Recent Advancements in Wireless Communications, Signal and Image Processin(ICWCSIP2020),OrganizedbyChenniInstituteof Technology,from 29th-30th June,2020.
[33] ChethanChandraSBasavaraddi,"FaceRecognitionFromFeed ForwardNeural NetworkUsingOccludedImagesForAutomatingTheSurveillanceUsing HybridNeuro Fuzzy Network", InternationalJournalofEngineering Applied Sciences and Technology,2020 Vol. 5, Issue 2,ISSN No. 2455-2143,Pages508-519 Published OnlineJune2020 inIJEAST(http://www.ijeast.com).
[34] ChethanChandraSBasavaraddi,"MultipleObjectTrackingUsingHybridNeuroFuzzyNetworkAppliedtoFaceRecognitionfromFeedForwardNeuralNetwork",International Journal of Advanced Research in Computer and Communication Engineering Vol.9,Issue 7,July2020, DOI 10.17148/IJARCCE.2020.9707,ISSN (Online) 2278-1021ISSN(Print)2319-5940.
[35] Chethan Chandra S Basavaraddi, "Deep Affinity to Multiple Object Tracking UsingHybrid Neuro Fuzzy Network Applied to Face Recognition", Journal of Seybold Report,VOLUME15ISSUE8 2020 ,ISSN NO: 1533-9211.
[36] Chethan Chandra S Basavaraddi, "Deep Learning Based Multiple Object Tracking forFacial Images Using Hybrid Neuro Fuzzy Network", International Journal of Scientific &EngineeringResearch Volume11, Issue8,August-2020 1096 ISSN 2229-5518.
[37] Taek-YoungYoun, Nam-SuJho, KyungHyuneRhee, and SangUkShin,"AuthorizedClient-SideDeduplicationUsingCP-ABEinCloudStorage",HindawiWirelessCommunicationsandMobileComputingVolume2019,ArticleID7840917,11pages
[38] https://doi.org/10.1155/2019/7840917.
[39] AtenieseG.,KamaraS.,KatzJ.(2009)ProofsofStoragefromHomomorphicIdentification Protocols. In: Matsui M. (eds) Advances in Cryptology – ASIACRYPT 2009.ASIACRYPT2019.LectureNotesinComputerScience,vol5912.Springer,Berlin,Heidelberg.https://doi.org/10.1007/978-3-642-10366-7_19.
[40] S EzhilArasu, B Gowri, and S Ananthi. Privacy-Preserving Public Auditing in cloud using HMACAlgorithm. International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277,3878,2020.
[41] More, Swapnali& Chaudhari, Sangita. (2021). Third Party Public Auditing Scheme forCloudStorage.ProcediaComputerScience.79.69-76.10.1016/j.procs.2016.03.010.