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Developing Use Cases and State Transition Models for Effective Protection of Electronic Health Records (EHRs) in Cloud

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ABSTRACT: This paper proposes new object oriented design of use cases and state transition models to effectively guard Electronic Health Records (EHRs). Privacy-An important factor need to be considered while we publishing the microdata. Usually government agencies and other organization used to publish the microdata. On releasing the microdata, the sensitive information of the individuals are being disclosed. This constitutes a major problem in the government and organizational sector for releasing the microdata. In order to sector or to prevent the sensitive information, we are going to implement certain algorithms and methods. Normally there two types of information disclosures they are: Identity disclosure and Attribute disclosure. Identity disclosure occurs when an individual's linked to a particular record in the released Attribute disclosure occurs when new information about some individuals are revealed. This paper aims to discuss the existing techniques present in literature for preserving, incremental development, use cases and state transition models of the system proposed.

KEYWORDS: Electronic Health Records(EHRs), Privacy, Microdata, Medical Healthcare System, Database Security.

I. INTRODUCTION

Cloud computing appears to be focused on large scale of storage of information across multiple servers. Cloud computing undergoes several style of resources such as dynamism, abstraction and resource sharing. Day by day health issues and health problems are increasing so to maintain and monitor health data is important.

Cloud based technique helps health and clinical organization to concentrate more on improving quality of service of their health operations. MYPHR machine is a patient centric system. MYPHR are appealed to be the next generation consumer-centric information system that helps progress health care delivery, self-management and wellness by providing flawless and complete information, which increases understanding, capability and awareness. MYPHR machine designed to solve the problem in the health record portability and provide a tight bond relationship with the doctor or the institution and the patient. Main aspect of MYPHR machine design is to make the PHR data as portable. The remainder of the paper is organized as follows. Section 2 deals about Survey of Literature of Techniques prevailing to protect EHRs. Basic Primitives and Terminologies are discussed in Section 3. Section 4 discusses about the Use Case Modeling and State Transition model of security system for cloud based PHRs. Section 5 enumerates the advantages of the proposed system. Section 9 concludes the paper and outlines the direction for Future Work.

II. LITERATURE SURVEY

C. Vecchiola, M. Kirley, and R. Buyya (2009) presented a distributed implementation of a network based multi-objective evolutionary algorithm called EMO (Evolutionary Multi-objective Optimization) by using Offspring (EMO) application. Recently, the easy access to Grid and Cloud computing infrastructures has made the deployment of



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hierarchical models quite common. These models compose the previously discussed models to better exploit the heterogeneity of distributed computing resources that can be found within Enterprise Clouds or Computing Grids. The execution of the evolutionary algorithm is generally divided into layers and at each of the layers a different model can be used. The most common implementation is based on a two level structure which uses a multi-population coarse grained distribution model at the first level and a master-slave or a cellular model at the second level. The aim of Offspring is to minimize the code required to provide a distributed implementation of a population based meta heuristics without requiring the researchers to know distribution middleware APIs. It provides a friendly user environment for researchers in combinatorial optimization who do not want to be concerned about building interconnection software layers and learning underlying middleware APIs and provides a visual user interface that manages the execution of population based optimization algorithms, a set of APIs allowing researchers to write a plug-in for this environment quickly. Results show that the model proposed by Offspring is effective when there is a real need for a distributed implementation. In order to be effective network based evolutionary algorithms require at least 1000 individuals and the model proposed by Offspring provides an increasing speed up when the number of individuals is only 300. A preliminary analysis of the overhead introduced by Offspring and the Cloud middleware used shows encouraging results for large population sizes. The distribution infrastructure provided by Offspring does not affect the performance.

A. *Pegasus*

E. Deelman, G. Singh, M.-H. Su, J. Blythe, Y. Gil, C. Kesselman, G. Mehta, K. Vahi, G. B. Berriman, J. Good, A. Laity, J. C. Jacob, and D. S. Katz (2005) proposed, Pegasus framework that can be used to map complex scientific workflows onto distributed resources. The authors surveyed the existing workflow management systems like WebFlow, GridFlow, GridAnt, Nimrod-G and ASCI Grid. Webflow provides a multileveled system for high performance distributed computing and a visual programming aid. Gridflow provides a two-tiered architecture with global Grid workflow management and local Grid sub workflow scheduling. GridAnt employs an ant workflow processing engine. Nimrod-G is a cost and scheduling based resource management and scheduling system. ASCI Grid (Accelerated Strategic Computing Initiative Grid distributed resource manager), includes a desktop submission tool, a workflow manager and a resource broker. All the existing strategies focus on resource brokerage and scheduling strategies. But Pegasus uses the concept of virtual data and provenance to generate and reduce the workflows based on data products which have already been computed. It prunes the workflow based on the assumption that it is always more costly to compute the data product than to fetch it from an existing location. Pegasus also automates the job of replica selection so that the user does not have to specify the location of input data files. Pegasus can also map and schedule only portions of the workflow at a given time, using partitioning techniques. The major functionality of Pegasus includes defining the set of available and accessible resources, resource selection and task clustering.

B. *Taverna*

T. Oinn, M. Addis, J. Ferris, D. Marvin, M. Senger, M. Greenwood, T. Carver, K. Glover, M. R. Pocock, A. Wipat, and P. Li (2004) developed a tool Taverna for the composition and enactment of bioinformatics workflows for the life science community. The Taverna project has developed a tool for the composition and enactment of bioinformatics workflows for the life sciences community. The tool includes a workbench application which provides a graphical user interface for the composition of workflows. These workflows are written in a new language called the Simple conceptual unified flow language (Scufl), where by each step within a workflow represents one atomic task. The Taverna workflow system is available as open source and can be downloaded with example Scufl workflows from <http://taverna.sourceforge.net>.

C. *GridFlow*

J. Cao, S. A. Jarvis, S. Saini, and G. R. Nudd (2003) developed GridFlow, a workflow management system for grid computing. GridFlow, includes a user portal and services of both global grid workflow management and local grid sub-workflow scheduling. Simulation, execution and monitoring functionalities are provided at the global grid level, which work on top of an existing agent-based grid resource management system. At each local grid, sub-workflow scheduling and conflict management are processed on top of an existing performance prediction based task scheduling system. A fuzzy timing technique is applied to address new challenges of workflow management in a cross-domain and highly dynamic grid environment. A case study is given and corresponding results indicate that local and global grid



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workflow management can coordinate with each other to optimize workflow execution time and solve conflicts of interest.

D. *ICENI*

N. Furmento, W. Lee, A. Mayer, S. Newhouse, and J. Darlington (2002) developed an open grid service architecture Imperial College e-Science Networked Infrastructure (ICENI) implemented with Jini. It is an extension of the current Grid in which information and services are given well-defined meaning, better enabling computers and people to work in cooperation. Jini :a technology of plug-and-play. Allow people to use networked devices and services as simply as using a phone today. Features of JINI include dynamic registration, service lookup, distributed object access and the platform-portability provided by java

E. *GridAnt*

K. Amin, G. von Laszewski, M. Hategan, N. J. Zaluzec, S. Hampton, and A. Rossi (2004) developed an extensible client-side workflow management system, called GridAnt. Design principles, functionality, and application of the proposed GridAnt workflow manager are also discussed. Features of the Proposed GridAnt tool: 1. Enabling Grid users to orchestrate complex workflows on the fly without substantial help from the service providers and 2.The Grid user might not be burdened with the intricacies of the workflow system GridAnt essentially consists of four components namely a workflow engine, a runtime environment, a workflow vocabulary, and a workflow monitor. Apache Ant is selected as the GridAnt workflow engine because of its extensibility and popularity in the Java community.

F. *Triana*

I. Taylor, I.Wang, M. Shields, and S. Majithia (2005) developed Triana, a distributed problem-solving environment. Triana enable a user to: 1.compose applications from a set of components, 2.select resources on which the composed application can be distributed and then execute the application on those resources

G. *Kelper:*

B. Lud'ascher, I. Altintas, C. Berkley, D.Higgins, E. Jaeger,M. Jones, E. A. Lee, J. Tao, and Y. Zhao (2006) developed a 'Kelper' a scientific workflow system to describe characteristics of and requirements for scientific workflows as identified in a number of application projects. Kepler, is a particular scientific workflow system, currently under development across a number of scientific data management projects. Kepler is a community-driven, open source project.

The above mentioned projects on Workflow Management System (WfMS), schedules tasks onto resources based on Earliest Finishing Time or Earliest Starting Time or high processing capabilities. This approach is termed to be the Best Resource Selection (BRS) approach, where a resource is selected based on its performance.

III. BASIC PRIMITIVES AND TERMINOLOGIES

Cloud environment may describe a company, organization or an individual who uses a Web based application for every mission rather than installing software and storing data on a computer. Cloud environment involves in provide a functionality to outsource and encrypt the data. Cloud storage service is accessed through the cloud computer service, web service application programming interface or by a cloud storage gateway. The cloud based workspace is centralized providing easy functionality to share. The cloud environment can provide improvements in system efficiency & density. Cloud environment solve the problem of complicated configuration management, Decreased productivity, Limited accessibility and Poor collaboration. It has the capability to access all work, databases and other information from any device. Cloud environment involves in providing some basic network model for storage of data in the cloud. The basic network model for the cloud data storage and three different network entities are

1. User
2. Cloud storage server
3. Cloud service provide



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- a. **User:** An entity which has large data files to be stored in the cloud and relies on the cloud for data maintenance and computation can be either individual consumers or organizations.
- b. **Cloud Storage Server (CSS):** An entity which is managed by Cloud service provider. Cloud storage is a subgroup of cloud computing. Cloud computing organizations offer users access to not only storage, but also processing power and computer applications mounted on a remote network. Cloud storage provides users with instant access to a wide ranging of resources and applications hosted in the infrastructure of another organization through a web service interface. Security of stored data and data transfer may be a concern during storing the sensitive data at a cloud storage provider.
- c. **Cloud Service Provider (CSP):** A cloud provider is a company that compromises some constituent of cloud computing has significant storage space and computation resource to maintain the user data. The Data owner encrypted some keywords about his data, and service provider supported the owner to retrieve his data by keywords and not allow others to retrieve. When supposing the role of cloud provider, an organization is accountable for making cloud services available to cloud customers.

IV. USE CASE MODELLING

Use case diagrams model the functionality of a system using actors and use cases. Use cases are services or functions provided by the system to its users. The components in a use case diagram include:

- **Actors:** Actors represent external entities of the system. These can be people or things that interact with the system that is being modeled. For example, if we are modeling an online store we have many actors that interact with the store functionality. The customer browses the catalog, chooses items to buy, and pays for those items. A stocker will look at the orders and package items for the customer. A billing system will charge the customer's credit card for the amount purchase.
- **Use Cases:** Use cases are functional parts of the system. When we say what an actor does, that's a use case. The customer "browses the catalog", "chooses items to buy", and "pays for the items". These are all use cases. Many actors can share use cases. If we find a use case that is not associated with any actor, this may be a unnecessary functionality.
- **Associations:** Associations are shown between actors and use cases, by drawing a solid line between them. This only represents that and actor uses the use case.

There are also two kinds of relationships between use cases:

- **Includes :** Use cases that are associated with actors can be very general. Sometimes they "include" more specific functionality. For example, the "pump gas" use case that is associated with the customer includes three use cases: Choose Gas Type, Fill Tank, and Calculate Total. Includes relationship is represented by dashed arrows that point to the included functionality. Beside the arrow is <<includes>>.
- **Extends :** An extension use case is an insertion to the base use case. For example, some stores may allow for different payment options like credit card, debit card, or cash on delivery. These specific functionalities are extension of the general "pay for items." Extends relationship is represented by dashed arrows that point to the base functionality. Beside the arrow is <<extends>>

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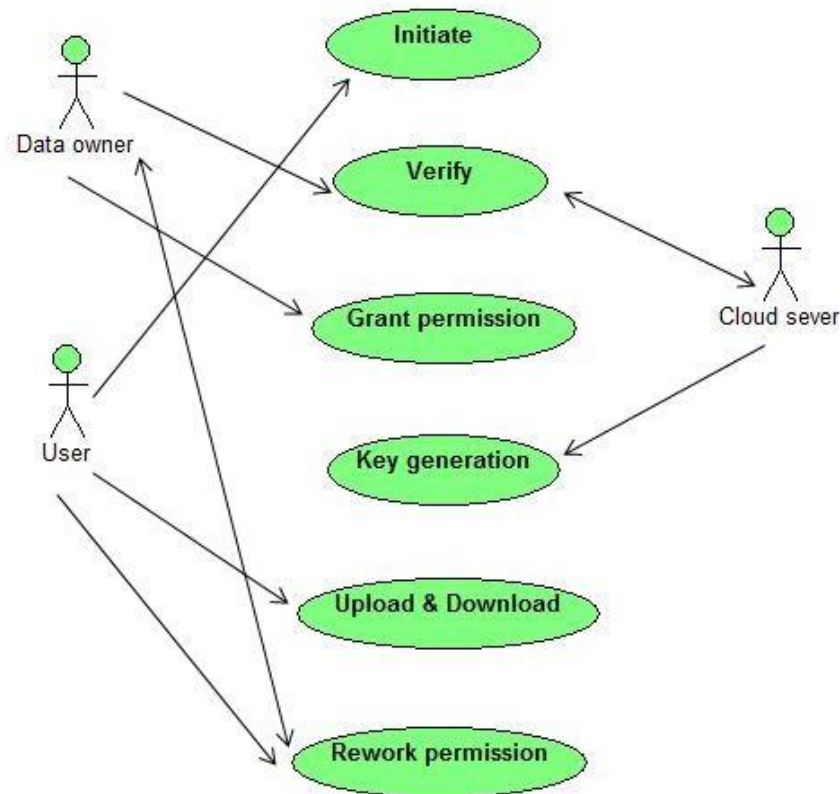


Fig 1. Use Case Diagram of Cloud Based MyPHR Machine

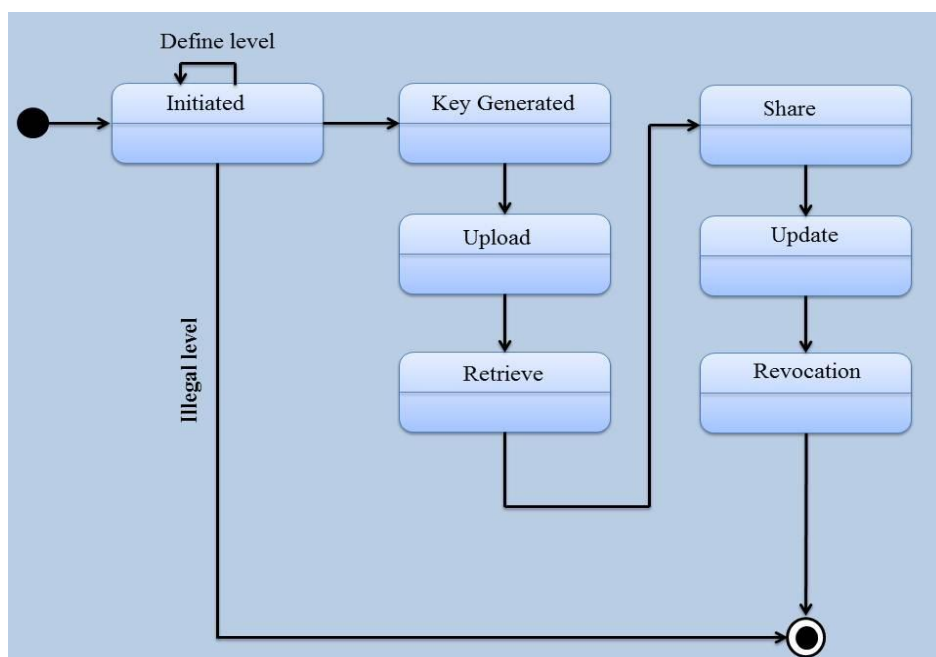


Fig 1. State Transition Diagram of Cloud Based MyPHR Machine



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V. CONCLUSION AND FUTURE WORK

This paper proposed new object oriented design of use cases and state transition models to effectively guard Electronic Health Records (EHRs). In this paper, the issue of outsourcing of data in cloud is addressed by the method of key generation for cloud user. Cloud computing, besides providing a maximized effectiveness of shared resources, also provides an easy way of storing and retrieving data. Personal Health Records (PHRs) are designed to maintain lifelong details of patients. Automated Patient Identifier and Patient Care System is designed to count hospitalized patients based on the concept of Current Procedure Terminology (CPT) manager. Cloud storage service is accessed through the cloud computer service, web service application programming interface or by a cloud storage gateway. The cloud based workspace is centralized providing easy functionality to share. The cloud environment can provide improvements in system efficiency & density. As a part of future work, we have planned design the UML diagrams to look into the problem and to increase the clarity and to implement the uploading of encrypted medical data in cloud and in the process of creating individual cloudlets for preventing unauthorized user.

REFERENCES

- [1] Pieter Van Gorp and Marco Comuzzi "Lifelong Personal Health Data and Application Software via Virtual Machines in the Cloud" IEEE Journal of Biomedical and Healthcare Informatics, Vol. 18, No. 1, Jan 2014
- [2] Lichtenstein Eric Stefan 1984 a, Computer control medical care system US4464172.
- [3] ARalph R.Frerichs, Dr. PH.Robert A. Miller 1985, Introduction of a Microcomputer for Health Research in a Developing Country.
- [4] Steven P.Brown 1986, Combinational Medical Data, Identification and health Insurance card.
- [5] Peter P. Gomblich, Richard J. Beard, Richard A. Griffee, Thomas R. Wilson, Ronald E. Zook, Max S. Hendrickson 1989,A Patient care system,US4835372 A.
- [6] Neil Bodick, Andre L. Marquis1990, Interactive system and method for creating and editing a knowledge base for use as a computerized aid to the cognitive process of diagnosis,US4945476 A.
- [7] Angela M. Garcia, Dr.,Boca Raton 1991 a, System and Method for scheduling and Reporting Patient related services including prioritizing services,US5974389 A.
- [8] Clark Melanie Ann, John Finley, Huska; Michael Edward, Kabel; Geoffrey Harold, Graham, Marc Merrill 1991 b,System and Method for scheduling and Reporting Patient Related services.
- [9] Robert W. Kukla1992,Patent care communication system, US5101476 A
- [10] Mark C. Sorensen 1993, Computer aided medical diagnostic method and apparatus, US5255187 A.
- [11] Edward J. Whalen, San Ramon, Olive Ave Piedmont 1994,Computerized file maintenance System for managing medical records including narrative patent documents reports.
- [12] Desmond D. Cummings 1994b,All care health management system, US5301105 A.
- [13] Woodrow B. Kesler Rex K Kesslerin 1994 c,Medical data draft for tracking and evaluating medical treatment.
- [14] Joseph P. Tallman, Elizabeth M. Snowden, Barry W. Wolcott 1995, Medical network management system and process, US5471382 A.
- [15] Peter S. Stutman, J. Mark Miller 1996,Medical alert distribution system with selective filtering of medical information
- [16] Edwin C. Iliff1997,computerized medical diagnostic system including re-enter function and sensitivity factors, US5594638 A.
- [17] Timothy Joseph Graettinger, Paul Alton DuBose 1998, Computer-based neural network system and method for medical diagnosis and interpretation. US5839438 A.
- [18] Melanie Ann Clark, John Finley Gold, Michael Edward Huska, Geoffrey Harold Kabel, Marc Merrill Graham1999,Medical record management system and process with improved workflow features, US5974389 A.
- [19] Richard S. Surwit, Lyle M. Allen, III, Sandra E. Cummings 2000 a, Systems, methods and computer program products for monitoring, diagnosing and treating medical conditions of remotely located patients, US6024699 A.
- [20] Jeffrey J. Clawson 2000 b, Method and system for giving remote emergency medical counsel to choking patients, US6010451 A.
- [21] Marc Edward Chicorel 2001, Computer keyboard-generated medical progress notes via a coded diagnosis-based language, US6192345 B1.
- [22] Charlyn Jordan2002, Health analysis and forecast of abnormal conditions.
- [23] Jeffrey J. Clawson2003, Method and system for an improved entry process of an emergency medical dispatch system
- [24] PekkaRuotsalainen 2004, A cross-platform model for secure Electronic Health Record communication.
- [25] Roger J. Quy2005, Method and apparatus for health and disease management combining patient data monitoring with wireless internet connectivity, US6936007 B2.
- [26] Avner Amir, Avner Man2006 a, System and method for administration of on-line healthcare, WO2006006176 A2.
- [27] Paul C.Tang, Joan S. Ash, David W. Bates, J. Marc overhage and Daniel Z.Sands 2006 b, Personal Health Records: Definitions, Benefits, and Strategies for Overcoming Barriers to Adoption.
- [28] Christopher Alban, KhiangSeow2007, Clinical documentation system for use by multiple caregivers.
- [29] Brian A. Rosenfeld, Michael Breslow2008, System and method for accounting and billing patients in a hospital environment.
- [30] Jacquelyn Suzanne Hunt, Joseph Siemenczuk 2009, Process and system for enhancing medical patient care.
- [31] Richard J. Schuman2010, Health care computer system, US7831447 B2.
- [32] Kanagaraj, G.Sumathi, A.C.2011,Proposal of an open-source Cloud computing system for exchanging medical images of a Hospital Information System
- [33] AvulaTejaswi, NelaManoj Kumar, GudapatiRadhika, SreenivasVelagapudi 2012 a, Efficient Use of Cloud Computing in Medical Science.
- [34] J. Vidhyalakshmi, J. Prassanna 2012 b, Providing a trustable healthcare cloud using an enhanced accountability framework.



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(An ISO 3297: 2007 Certified Organization)

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- [35] Carmelo Pino and Roberto Di Salvo 2013, A Survey of Cloud Computing Architecture and Applications in Health.
- [36] K.S. Aswathy, G. Venifa Mini 2014 a, Secure Alternate Viable Technique of Securely Sharing the Personal Health Records in Cloud.
- [37] Abhishek Kumar Gupta, Kulvinder Singh Mann 2014 sharing of Medical Information on Cloud Platform.
- [38] D. C. Kaelber, A. K. Jha, D. Johnston, B. Middleton, and D. W. Bates, "Viewpoint paper: research agenda for personal health records (PHRs)," J. Amer. Med. Inform. Assoc., vol. 15, no. 6, pp. 729–736, 2008.
- [39] J. Ahima, "Defining the personal health record," vol. 76, no. 6, pp. 24–25, Jun. 2005.
- [40] W. Currie and M. Guah. "Conflicting institutional logics: a national programme for it in the organizational field of healthcare:," Journal of Information Technology, 22:235–247, 2007.
- [41] M. Gysels, A. Richardson, and J. I. Higginson "Does the patient-held record improve continuity and related outcomes in cancer care: a systematic review", Health Expectations, 10(1):75–91, Mar. 2007.
- [42] International Organization for Standardization. ISO TR20514:2005 Health Informatics - Electronic Health Record Definition, Scope and Context Standard. International Organization for Standardization (ISO). Geneva, Switzerland, 2005.
- [43] B.Powmeya, Nikita Mary Ablett, V.Mohanapriya, S.Balamurugan, "An Object Oriented approach to Model the secure Health care Database systems," In proceedings of International conference on computer, communication & signal processing (IC³SP) in association with IETE students forum and the society of digital information and wireless communication, SDIWC, 2011, pp.2-3
- [44] Balamurugan Shanmugam, Visalakshi Palaniswami, "Modified Partitioning Algorithm for Privacy Preservation in Microdata Publishing with Full Functional Dependencies", Australian Journal of Basic and Applied Sciences, 7(8): pp.316-323, July 2013
- [45] Balamurugan Shanmugam, Visalakshi Palaniswami, R.Santhya, R.S.Venkatesh "Strategies for Privacy Preserving Publishing of Functionally Dependent Sensitive Data: A State-of-the-Art-Survey", Australian Journal of Basic and Applied Sciences, 8(15) September 2014.
- [46] S.Balamurugan, P.Visalakshi, V.M.Prabhakaran, S.Chranyaa, S.Sankaranarayanan, "Strategies for Solving the NP-Hard Workflow Scheduling Problems in Cloud Computing Environments", Australian Journal of Basic and Applied Sciences, 8(15) October 2014.
- [47] Charanyaa, S., et. al., , A Survey on Attack Prevention and Handling Strategies in Graph Based Data Anonymization. International Journal of Advanced Research in Computer and Communication Engineering, 2(10): 5722-5728, 2013.
- [48] Charanyaa, S., et. al., Certain Investigations on Approaches for Protecting Graph Privacy in Data Anonymization. International Journal of Advanced Research in Computer and Communication Engineering, 1(8): 5722-5728, 2013.
- [49] Charanyaa, S., et. al., Proposing a Novel Synergized K-Degree L-Diversity T-Closeness Model for Graph Based Data Anonymization. International Journal of Innovative Research in Computer and Communication Engineering, 2(3): 3554-3561, 2014.
- [50] Charanyaa, S., et. al., , Strategies for Knowledge Based Attack Detection in Graphical Data Anonymization. International Journal of Advanced Research in Computer and Communication Engineering, 3(2): 5722-5728, 2014.
- [51] Charanyaa, S., et. al., Term Frequency Based Sequence Generation Algorithm for Graph Based Data Anonymization International Journal of Innovative Research in Computer and Communication Engineering, 2(2): 3033-3040, 2014.
- [52] V.M.Prabhakaran, Prof.S.Balamurugan, S.Charanyaa, " Certain Investigations on Strategies for Protecting Medical Data in Cloud", International Journal of Innovative Research in Computer and Communication Engineering Vol 2, Issue 10, October 2014
- [53] V.M.Prabhakaran, Prof.S.Balamurugan, S.Charanyaa, " Investigations on Remote Virtual Machine to Secure Lifetime PHR in Cloud ", International Journal of Innovative Research in Computer and Communication Engineering Vol 2, Issue 10, October 2014
- [54] V.M.Prabhakaran, Prof.S.Balamurugan, S.Charanyaa, " Privacy Preserving Personal Health Care Data in Cloud" , International Advanced Research Journal in Science, Engineering and Technology Vol 1, Issue 2, October 2014
- [55] P.Andrew, J.Anish Kumar, R.Santhya, Prof.S.Balamurugan, S.Charanyaa, "Investigations on Evolution of Strategies to Preserve Privacy of Moving Data Objects" International Journal of Innovative Research in Computer and Communication Engineering, 2(2): 3033-3040, 2014.
- [56] P.Andrew, J.Anish Kumar, R.Santhya, Prof.S.Balamurugan, S.Charanyaa, " Certain Investigations on Securing Moving Data Objects" International Journal of Innovative Research in Computer and Communication Engineering, 2(2): 3033-3040, 2014.
- [57] P.Andrew, J.Anish Kumar, R.Santhya, Prof.S.Balamurugan, S.Charanyaa, " Survey on Approaches Developed for Preserving Privacy of Data Objects" International Advanced Research Journal in Science, Engineering and Technology Vol 1, Issue 2, October 2014
- [58] S.Jeevitha, R.Santhya, Prof.S.Balamurugan, S.Charanyaa, " Privacy Preserving Personal Health Care Data in Cloud" International Advanced Research Journal in Science, Engineering and Technology Vol 1, Issue 2, October 2014.
- [59] K.Deepika, P.Andrew, R.Santhya, S.Balamurugan, S.Charanyaa, "Investigations on Methods Evolved for Protecting Sensitive Data", International Advanced Research Journal in Science, Engineering and Technology Vol 1, Issue 4, December 2014.
- [60] K.Deepika, P.Andrew, R.Santhya, S.Balamurugan, S.Charanyaa, "A Survey on Approaches Developed for Data Anonymization", International Advanced Research Journal in Science, Engineering and Technology Vol 1, Issue 4, December 2014.
- [61] S.Balamurugan, S.Charanyaa, "Principles of Social Network Data Security" LAP Verlag, Germany, ISBN: 978-3-659-61207-7, 2014
- [62] S.Balamurugan, S.Charanyaa, "Principles of Scheduling in Cloud Computing" Scholars' Press, Germany,, ISBN: 978-3-639-66950-3, 2014
- [63] S.Balamurugan, S.Charanyaa, "Principles of Database Security" Scholars' Press, Germany, ISBN: 978-3-639-76030-9, 2014

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