Certain Investigations on Strategies for Protecting Medical Data in Cloud

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ABSTRACT: This paper reviews methods to protect medical data in distributed cloud for the past 30 years. The paper deals about the development of Early Computer Based Medical Healthcare Systems since 1984. The Evolution of Electronic Healthcare Record Management consisting of several electronic items is discussed. Various methods of Computer Aided Maintenance of Medical Files color coding, virtually unlimited character length are portrayed. Computerized Medical Diagnostic Maintenance System which speaks about computerized, knowledge based medical diagnostic and treatment advice and application of neural network system in medical diagnosis is dealt in detail. Workflow Based Medical Record Management System neural network are discussed. Various Models for Secure Electronic Health Record Communication Enhanced cross security which supports a platform for communication through the adhoc network to access the distributed electronic health records discussed in detail. Automated Patient Identifier and Patient Care Systems details about method for counting hospitalized patient the concept of current procedural terminology (CPT) manager. A data warehouse receives the extracted information and reformats that information is portrayed. Personal Healthcare Records Maintenance in Cloud are also dealt in detail.

KEYWORDS: Computer Based Medical Healthcare System, Computerized Medical Diagnosis, Neural Network, Automated Patient Identifier, Cloud Computing.

I. INTRODUCTION

The development of Early Computer Based Medical Healthcare Systems is rooted since 1984. The Evolution of Electronic Healthcare Record Management consisting of several electronic items such as Remote terminals, Conventional telephone wiring, Bar code reading device, and LCD display is discussed. Various methods of Computer Aided Maintenance of Medical Files color coding, virtually unlimited character length and selective filtering of medical information are discussed. Computerized Medical Diagnostic Maintenance System which speaks about computerized, knowledge based medical diagnostic and treatment advice and application of neural network system in medical diagnosis is dealt in detail. Workflow Based Medical Record Management System caregiver computers, emergency medical counsel to choking patients remotely, coded diagnosis-based language consisting of 350,000 bytes of medical descriptive to paradigm particular medical progress note, concept of predetermined health parameter is discussed. Various Models for Secure Electronic Health Record Communication Enhanced cross security platform is proposed which support a platform for communication through the adhoc network to access the distributed electronic health records, end-unit device is guided by the CMIP and a computer based system for recording, storing, accessing and retrieving clinical documentation where the care setting are discussed in detail. Automated Patient Identifier and Patient Care Systems details about method for counting hospitalized patient the concept of current procedural terminology (CPT) manager which assigns CPT codes is discussed. and system for enhancing medical patient care. A data warehouse receives the extracted information and reformats that information is portrayed. Personal Healthcare Records Maintenance in Cloud describes a A hospital bed, patient and nurse call system and an open-source Cloud computing system for exchanging medical images of a Hospital Information System, trustable healthcare cloud using an enhanced accountability framework, is discussed. Secure Alternate Viable Technique of Securely Sharing the Personal Health Records in Cloud which involves exchange of personal health record between multiple caregivers is discussed. Sharing of Medical Information on Cloud Platform is explored that basically hospitals store the patient details in paper format now in the migration to next level medical information are stored in cloud computing which provide a secure way to share.

The remainder of the paper is organized as follows. Section 2 deals about Early Computer Based Medical Healthcare Systems. The Evolution of Electronic Healthcare Record Management is discussed in Section 3. Section 4 portrays the methods of Computer Aided Maintenance of Medical Files. Computerized Medical Diagnostic Maintenance System is

dealt in Section 5. Section 6 briefs about Workflow Based Medical Record Management System. Various Models for Secure Electronic Health Record Communication are discussed in detail in Section 7. Section 8 details about Automated Patient Identifier and Patient Care Systems. Personal Healthcare Records Maintenance in Cloud in described in Section 9. Section 10 Concludes the paper and outlines the direction for Future Work

II. LITERATURE SURVEY - EARLY COMPUTER BASED MEDICAL HEALTHCARE SYSTEMS

Lichtenstein Eric Stefan (1984 a) Proposed "Computer control medical care system" which defined a manual or automatic control of medical procedures including diagnostic procedures. Microcomputer monitors the status of the patient modular vessel structure. The System analyzes the fluid taken from individual and analyzes the mixture of appropriate medications. Modular vessel structures are keyed to exact programs, thereby prevent operator errors and increasing the consistency of the system.

Robert S. Behl, Falrport, Sybron Corporation, Rochester (1984) [2] proposed "Electronic Medication Dispensing System" in which they explored an idea of Electronic portable dispensing system has several compartments for storing medical details and store bills. Dispensing system is programmed with visual and audio signals when medication is to be consumed. The medication details include the patient health habits. The programming means may be integral with dispensing or a separate unit.

Ralph R.Frerichs, Dr. PH.Robert A. Miller (1985) [3] in "Introduction of a Microcomputer for Health Research in a Developing Country" described a Powerful microcomputer assist health professionals at the National Institute for Preventive and Social Medicine (NIPSOM) in verify and analyzing locally derived health data. They share the results of their research with other public health and medical colleagues, provide administrators with timely analyses for policy or program implementation, it was possible to assemble and transport a powerful computer system to a technologically less developed country and provide effective health report of a patient. Steven P.Brown (1986) [4] Proposed "Combinational Medical Data, Identification and health Insurance card" which describe Combinational Medical Data, Identification and health Insurance card provides two leaves each are interconnected by a self-hinge. The Data include eye readable material on the card and also microfilm strip associated with the card and machine readable such as electrocardiogram. ERobert J. Schwartz., Kenneth M. Weis., Anne V. Buchanan Dr. P.H(1987) [32] in "Error Control in Medical Data" defines a automated billing system basically has errors, however the errors are controlled and solution is provided an automated record management.

III. EVOLUTION OF ELECTRONIC HEALTHCARE RECORD MANAGEMENT

Peter P. Gombrich, Richard J. Beard, Richard A. Griffee, Thomas R. Wilson, Ronald E. Zook, Max S. Hendrickson (1989) [5] defined "A Patient care system" which consists of several electronic items such as Remote terminals, Conventional telephone wiring, Bar code reading device, and LCD display. Bar code reading device read a patient's unique bar code ensuring that an item corresponds to an identified patient to ensure that the item properly corresponds to the identified patient.

Neil Bodick, Andre L. Marquis (1990) [6] proposed "Interactive system and method for creating and editing a knowledge base for use as a computerized aid to the cognitive process of diagnosis" explain that a Knowledge base computerized system has textual and pictorial information of medical information of patient. Case records are stored and retried using a optical disk or magnetic disk when needed this pictorial information's are displayed.

Angela M. Garcia, Dr.,Boca Raton (1991 a) [7] defined "System and Method for scheduling and Reporting Patient related services including prioritizing services" in which they explain that Hospital management system has a terminal in all department of hospital for storing the details of patient admission information, health reports and examination results. Each department prints the medical information of a patient and saves in the terminal which can be used for identifying patient health status. The system can print the information and diagnosis the problems. Additionally nurse notes and findings are entered in the system and printed when needed. Finally they print the patient instruction document and discharging details. Clark Melanie Ann, John Finley, Huska; Michael Edward, Kabel; Geoffrey Harold, Graham, Marc Merrill (1991 b) [8] proposed "System and Method for scheduling and Reporting Patient Related services" in which they explore a Medical record management system includes Caregiver computers and a patient

database which has patient data coupled to the caregiver computers selectively providing access to the patient data from one of the caregiver computers responsive to a predetermined set of access rules. First caregiver must be terminated before access to the same predetermined portion by a second caregiver is allowed.

Robert W. Kukla (1992) [9] defined "Patient care communication system" in which they describe A Patient care communication system has communication terminals which coupled together for the transmission and receipt of the messages. Information such as patient lists and address lists to be included in messages required to send for the proficient operation of the patient care facility.

IV. COMPUTER AIDED MAINTENANCE OF MEDICAL FILES

Mark C. Sorensen (1993) [10] in "Computer aided medical diagnostic method and apparatus" discussed that Computer aided medical diagnostic method has a diagnosis information. Disease are color coded according the significance of the presence or absence of each finding in ruling in or ruling out the possibility of the disease being present on a color display to aid a doctor or other user to diagnose or study disease.

Edward J. Whalen, San Ramon, Olive Ave Piedmont (1994 a) [11] in "Computerized file maintenance System for managing medical records including narrative patent documents reports" explored that Process multiple files of Client/Patient data which have record sets combining the file records of virtually unlimited character length used without reenter of previously entered data in the extended field.Desmond D. Cummings (1994 b) [12] defined "All care health management system" A fully integrated and wide-ranging health care system that includes the integrated interconnection within in a single system interaction of patient, health care provider, bank, financial institution, insurance company reviewer and employer provide patients with complete and inclusive pre-treatment, treatment and post-treatment health care. Woodrow B. Kesler Rex K Kesslerin (1994 c) [13] in "Medical data draft for tracking and evaluating medical treatment " explored the idea of introducing ambulatory patient care by gathering medical data on ambulatoty visit and provide data for each analysis process. Data drafts are provided to participating medical health care provider to define the issue of patient of they visit individually. Medical data summary is entered and monitored for accurate and reliable handling. Medical data drafts are issued to insurers and medical professions to examine the level of healthcare. Implementation of this medical data drafts includes significant cost savings for health care insurance system.

Joseph P. Tallman, Elizabeth M. Snowden, Barry W. Wolcott (1995) [14] in "Medical network management system and process" explored that In a medical network management system (NMS) defined health care professionals over telephone to guide and help the patient to access the health needs and right care. The NMS has a patient assessment component consists of a set of information tools which are used by health care professionals to assess patient conditions and support of health care services to help patients and care at the appropriate time. Tool based on branched chain algorithms utilizing Bayes theorem. These exclusive, clinical tools allow a trained nurse or other health care professional to sort patients into different risk groups. Patient can be guided properly based on their level of risk.

Peter S. Stutman, J. Mark Miller(1996) [15] in "Medical alert distribution system with selective filtering of medical information" A medical alert distribution system defined which receives medical information such as blood pressure, blood chemistry test results, etc., from monitoring units damaged by ambulatory patients. The system receives medical selection and limit parameters from remote system subscriber units where the units are accessed by the doctors. The system constantly compares the medical information received form the ambulatory patients to determine if a selected parameter, as designated by a declared in alert flag, has exceeded the limit parameters received form the remote subscriber units. If it exceeded, the system sends a message through wireless paging system to the system subscriber units which requested that the particular parameter be continuously compared against the selected limit parameters. Finally the system selectively filters information and allocates filtered information to a subscriber processing unit by way of communications network.

V. COMPUTERIZED MEDICAL DIAGNOSTIC MAINTENANCE SYSTEM

Edwin C. Iliff (1997) [16] proposed "Computerized medical diagnostic system including re-enter function and sensitivity factors" explained that a system and technique for providing computerized, knowledge based medical diagnostic and treatment advice. Medical advice is provided over a telephone network two specifications is determined

voice response and speech recognition are used to enable general consultant knowledge to be encoded for access. "Meta" functions for time-density analysis are defined as an integral part of the system. A semantic discrepancy evaluator with a mental status examination is used to sense the awareness level of a user of the system. A symptom severity analysis comforts to respond to the changing circumstances. System sensitivity factors may be altered at a global level or other levels to regulate the system advice as necessary.

Timothy Joseph Graettinger, Paul Alton DuBose (1998) [17] defined "Computer-based neural network system and method for medical diagnosis and interpretation" they explain the functions of neural network system in medical diagnosis they deliver an effectual support in identifying and interpreting factors which are important in the medical diagnosis. The neural network involved in recognizing the medical situations provided with input data that is offered for a number of patients and diagnosis made by physicians in each circumstance. The neural network system uses input dimension to produce data of patient's medical condition that is convoyed with a diagnosis clarification. The informational facility is based on contrast with a set of nominal values for each input factor. Involve in assist the physician in making a diagnosis of the patient's condition and provide a "second opinion" that explain the physician's findings for more detailed analysis.

VI. WORKFLOW BASED MEDICAL RECORD MANAGEMENT SYSTEM

Melanie Ann Clark, John Finley Gold, Michael Edward Huska, Geoffrey Harold Kabel, Marc Merrill Graham (1999) [18] in "Medical record management system and process with improved workflow features" defined that Medical record system of a patient system includes a caregiver computers and a patient record database includes patient data attached to the caregiver computers involved in providing access to the patient data from one of the caregiver computers receptive to a determined set of access rules. The determined set of rules includes access to a predetermined portion of the patient data by a first caregiver must be terminated before access to the same predetermined portion by a second caregiver is permitted.

Jeffrey J. Clawson (2000) [19] projected "Method and system for giving remote emergency medical counsel to choking patients" defined that Medical system provided for emergency medical counsel to choking patients remotely. Gather emergency medical information including medical dispatch services to choking victims and providing qualified emergency medical information to callers thereby permitting "zero time" response. Advantage of using this technique is a choking victim injuries can be treated with appropriate guidance. It is mostly useful for the remote emergency sufferers they provide a "zero time" response at the case of emergency.

Marc Edward Chicorel (2001) [21] proposes "Computer keyboard-generated medical progress notes via a coded diagnosis-based language". Through this medical progress note a doctor can utilize the base of about 350,000 bytes of medical descriptive to paradigm particular medical progress note. During completion of the patient meeting, the doctor proceeds to write a short "code" should have at least two letters in the suitable box on a predesigned form. Basically this process uses approximately 15 to 90 seconds of the doctor's time. The code is then entered into the programmed processor and information corresponding to the code is printed, analyzed and signed by the doctor. The printed and signed text is then entered into the patient's medical chart.

Charlyn Jordan (2002) [22] proposed "Health analysis and forecast of abnormal conditions". Health record signals are been stored and processed for the predetermined health function or parameter to define value in the abnormal range. Also future health signal record is to trend the predetermined function and assume a value in abnormal range and condition.

Jeffrey J. Clawson (2003) [23] defined "Method and system for an improved entry process of an emergency medical dispatch system". Standard process is involved in gathering and processing emergency medical information, categorizing such information into various basis levels for correct response and for providing qualified emergency medical information to callers thereby permitting "zero-time" response. Important function of this system is dispatcher is guided through the examination of callers, meeting the critical information dispatching the mobile care when needed and giving the appropriate guidance to the caller. It has universal entry protocol for accessing medical complaints.

VII.   MODELS FOR SECURE ELECTRONIC HEALTH RECORD COMMUNICATION

PekkaRuotsalainen (2004) [24] in "A cross-platform model for secure Electronic Health Record communication". Enhanced cross security platform is proposed which support a platform for communication through the adhoc network to access the distributed electronic health records. Roger J. Quy (2005) [25] in "Method and apparatus for health and disease management combining patient data monitoring with wireless internet connectivity". The health related data is communicated from the WWD to a server using standard internet protocols. Server calculates the response time and further it reviewed by a physician or health care provider. User and server interaction takes place the server transmits a response to the WWD and the user may answer the response.

Avner Amir, Avner Man (2006 a) [26] in "System and method for administration of on-line healthcare". The end-unit device is guided by the CMIP so that anamnesis, diagnosis treatment is provided, monitored, recorded and clinically investigated. This system is useful for the management of medical records. Paul C.Tang, Joan S. Ash, David W. Bates, J. Marc overhage and Daniel Z.Sands (2006 b) presented "Personal Health Records: Definitions, Benefits, and Strategies for Overcoming Barriers to Adoption" they explore the Personal Health record (PHR) systems for patients. They carry patient data, they combine data, knowledge and software tools which help the patient to handle their medical data they handle through a standalone computer.

Christopher Alban, KhiangSeow (2007) [28] defines a "Clinical documentation system for use by multiple caregivers" they explain that A computer based system for recording, storing, accessing and retrieving clinical documentation where the care setting is provided. In a single electronic database it stores clinical patient notes, provides multiple points of read/write access through user interface operating on single or more client computers that are in real time communication with the repository.

VIII.   AUTOMATED PATIENT IDENTIFIER AND PATIENT CARE SYSTEMS

Brian A. Rosenfeld, Michael Breslow (2008) [29] in "System and method for accounting and billing patients in a hospital environment". Patient identifier is associated with the billing service provided by the hospitalized unit. If the billable service is provided by a specialist, a specialist identifier is also associated with the billable service. The hospitalized patient is counted and a current procedural terminology (CPT) manager assigns CPT codes to the billable service. A bill generator receives all the details of the patient data, insurance information and CPT codes which generate a bill for the billable services provided to the hospitalized patient.

Jacquelyn Suzanne Hunt, Joseph Siemienczuk (2009) [30] in "Process and system for enhancing medical patient care" explored that a system that abstracts selected information. A data warehouse receives the extracted information and reformats that information. Information's are analyzed by a health care provider having that medical condition. It further collects the data of the selected patients for multiple health care providers and enables comparisons of health care provider's success for such patients to promote advance of the treatment by less successful providers.

IX.   PERSONAL HEALTHCARE RECORDS MAINTENANCE IN CLOUD

Richard J. Schuman (2010) [31] defines "Health care computer system" which define the A hospital bed, patient and nurse call system. A hospital network is provided. Communication is provided over a packet based communication network. Kanagaraj, G.Sumathi, A.C. (2011) [32] in "Proposal of an open-source Cloud computing system for exchanging medical images of a Hospital Information System" proposed clinical information system through the cloud can provide the essential details to the health care and the patient can seek the treatment in different hospital, reduce computational resource maintenance in the hospital also existing medical equipment's can be reconstructed to be more efficient and low-cost. J. Vidhyalakshmi, J. Prassanna (2012) [35] proposed "Providing a trustable healthcare cloud using an enhanced accountability framework" explored that Security and accountability of patient's personal health record maintenance it handle the Privacy protection problem. They define Distributed accountability framework to control and monitor user data in cloud. It also handle the object centric which automatically trigger an object to create a log record and access over distributed data. Log file corruptions are handled, log manager maintenance and verify corrupted log records. With the introduction of cloud computing in medical data capital expenditure is converted to operational expenditure.

Carmelo Pino and Roberto Di Salvo (2013) [36] in "A Survey of Cloud Computing Architecture and Applications in Health" explained that cloud computing act as an important alternative to ensure high performance data processing and manage the tool in easy manner. Cloud computing provide resource management and computation capabilities, hybrid cloud can increase the development of the health sector. K.S. Aswathy, G. Venifa Mini (2014 a) [37] in "Secure Alternate Viable Technique of Securely Sharing the Personal Health Records in Cloud" proposed a cloud environment for resource sharing it involves in exchange of personal health record between multiple caregivers. Encryption schemes are used to secure the data and provide a patient centric framework for sharing the personal health data. Abhishek Kumar Gupta, Kulvinder Singh Mann (2014 b) defined "Sharing of Medical Information on Cloud Platform" explored that basically hospitals store the patient details in paper format now in the migration to next level medical information are stored in cloud computing which provide a secure way to share. It results in the setting the platform for the exchange and collaboration of medical information.

X. CONCLUSION AND FUTURE WORK

Various methods to protect medical data in distributed cloud for the past 30 years is discussed. The paper dealt about the development of Early Computer Based Medical Healthcare Systems since 1984. The Evolution of Electronic Healthcare Record Management consisting of several electronic items is discussed. Various methods of Computer Aided Maintenance of Medical Files color coding, virtually unlimited character length are portrayed. Computerized Medical Diagnostic Maintenance System which speaks about computerized, knowledge based medical diagnostic and treatment advice and application of neural network system in medical diagnosis is dealt in detail. Workflow Based Medical Record Management System neural network are discussed. Various Models for Secure Electronic Health Record Communication Enhanced cross security which support a platform for communication through the adhoc network to access the distributed electronic health records discussed in detail. Automated Patient Identifier and Patient Care Systems details about method for counting hospitalized patient the concept of current procedural terminology (CPT) manager. A data warehouse receives the extracted information and reformats that information is portrayed. Personal Healthcare Records Maintenance in Cloud are also dealt in detail. This survey would promote a lot of research directions in the field of medical data storage and protection in cloud.

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