DESIGN AND OPTIMIZATION OF NEXT GENERATION AUTOMATED ELECTRONIC MEDICAL EXPERT SYSTEMS

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Abstract—The necessity of human needs expands exponentially with every second that engrosses. The ease of using human-like intelligent and expert systems in day-to-day activities is on the verge of becoming a must. Similarly, the medical field is another aspect that corresponds to an increase in the type of services rendered and ailments treated with direct proportion to an increase with human existence. Thus the collaboration of both these aspects together into one system encompasses the vital need of future enhancements in the technical aspects of how humans are treated with respect to medical sciences. Each one in the mankind world is considered to be treated in an obsolete manner if their medical history is found to be absent or complicated. Hence there is a requisite for a medical tracking system that automates the reports and medication given to each one of the 23 pairs of chromosomes of each human. Thus a medical tracker that helps to store the patients’ details, auto-retrieves it based on the medication prescribed and also shows the automated dosage level of each medicine that generates based on the type of ailment, helps the patient to be universal treatment, irrespective of his unknown origin or past health knowledge.

Index Terms—Automated dosage level, auto retrieves, expert systems, human-like, medical history, medical tracking system, universal treatment.

1 INTRODUCTION

The main ideology in e-medical systems is to maintain a database that can be effectively and efficiently used for patient records and treatment. The medical systems work on the concept involving electronic health records (EHR). A web document that is rich in technologies like Servlet, DOM and other web technologies and uses Biometric Pattern matching to also improve the security and intelligence of the system. This type of system hence alerts patient time to time regarding their medical records, easing human efforts and medical treatment, implementing with the essential and efficient use of today’s technology.

2 EXISTING SYSTEM AND USES

2.1 Initial Stages

The initial stages of the system started as early as modern era of medical treatments began. The paper based report generation and its maintenance had been an intense process of medical record as well as medical treatment amenities.

2.2 Present Stage

Today’s health information management industry is still based on the founding goal of the first medical record librarians: to increase and improve the clinical documentation standards. The industry has come a long way from keeping hard copies of health records, but the ultimate goal of fully functional EHR is yet to be realized.

2.3 Disadvantages

The most obvious disadvantages are the list and pile of paper based records that are maintained. Some of the other disadvantages include:

Cost – There are different types of cost involved in keeping patient records manually. Making copies of records and hiring the staff to perform clerical work can add up. Hospitals have to store the records in filing cabinets that can use up valuable space. Often, patients must re-take tests due to lost or missing results, and repeating procedures only adds to the cost.

Time Consumption – When you file paper records, there is a tendency for documents to be misfiled or lost and searching for them wastes valuable time and energy. Delivering the paper records to a specific location can also take up valuable time. Hospitals normally require particular reports from different hospital departments; using paper records to sort and organize certain data for these reports can take a long time and errors can easily be made.

Access to Medical Records – Since only one person at a time can have access to a medical chart, production and results can be delayed. Being able to retrieve a patient's records with all of their medical history and current issues is what makes a doctor effective and efficient. Having limited or delayed access to medical records can be problematic not just for the doctors, but for all hospital departments.

Integrity of Information – Since paper is easily torn or damaged, there is no guarantee that someone's medical record is safe. Ink can fade, water can saturate and mold, and fire can be a serious threat. Incomplete or inaccurate data can be collected on records, since not every provider uses the same
terminology or format. Handwriting can be illegible, causing mistakes in treatments or medication.

3 Proposed System

The proposed system is made to function and ease out the human efforts into the databases, data retrieval and report generation.

The salient features of this proposed model includes:

- Universal Medication ID to each patient
- Cloud based data storage and retrieval
- Intelligent medical tracker
- Intelligent dosage level identifier
- Report generation based on the corresponding disease/infection
- Auto scan optimizer of old reports and data storage

Universal Medication ID-

The patients across the nation or globe, that is, if the system is proposed to be national or international respectively can be linked with an auto generated ID or a national ID which had earlier been generated (eg. Aadhar ID in India) that identifies them uniquely.

There is indeed a biometric authentication that can be used for this and can be linked with their ID for easy identification.

Cloud based storage-

The cloud based storage is one of the key aspects in this system. Each one of the inputs received by the doctor is given as input and stored in the cloud under the patients' unique ID.

In order to enhance total security and prevent hacking on the large scale, this cloud service can be taken by one of the prime leading market software and services leader. A cloud service provided especially for this medical services can be acclaimed by the Google for example, which not only offers the best opportunity to services but enhances total security as well.

Intelligent medical tracker-

The intelligent medical tracker identifies the patients' health record and medication been prescribed over the years based on the health record history.

The concept of artificial intelligence, of the concept of self-learning from a record of similar reports and scans, makes the system to clearly indicate the right medication for the right person based on his other list of ailments too.

Intelligent dosage level identifier-

The intelligent dosage level identifier revolves around the concept of data mining and self-learning principles. The system has the vision to understand and correspond to the probable set of diseases for which that medication might correspond to. Once that is enabled and enhanced, the system automatically picks the right dosage for that symptom and prescribes the effects that it could produce on the human body by having that medication.

Report generation based on the corresponding disease/infection -

Thus with both these above concepts put into the system, it is possible for the system to now enable the doctor to prescribe medication to the patients easily.

All the above software features are available only to a doctors’ login as this is meant only for their prescription purposes. It is possible sometimes that a neurologist might not exactly know what a dentist has prescribed as a medicine. If he overrides that dosage and prescribes something new for his patient’s present health conditions, it might have a side-effect and pop up a new concern. To avoid these cases, this software comes in very handy.

Automatic scan optimizer of old reports and data storage-

This is an all new concept of record maintenance. The scan reports and x-rays that have been taken up already in paper based medical records can be scanned up and loaded on to the patients’ online profile now under their universal medical ID and hence can be viewed by the patients in any device at any time. Similarly for any new doctor across the world, to whom the patient is completely new, can understand the patients’ medication history.

This also eradicates the fact of paper based medical records and enables online access to old and new records.

With all these concepts enabled, while some are existing and some proposed with respect to intelligent systems' involvement here are completely new, the immediate goals to this project is-

- Health information and data: Immediate access to key information, such as patients' diagnoses, allergies, lab test results, and medications, improves the ability for doctors and other healthcare providers to make sound clinical decisions in a timely manner.

- Result management: The ability for all doctors and other providers participating in the care of a patient in multiple settings to quickly access new and past test results would increase patient safety and the effectiveness of care.

- Order management: The ability to enter and store orders for prescriptions, tests, and other services in a computer-based system will enhance legibility, reduce duplication, and improve the speed with which orders are executed.

- Clinical decision support (CDS): Using reminder prompts and alerts, CDS would improve compliance with best clinical practices, ensure regular screenings and other preventive practices, identify possible drug interactions, facilitate diagnoses and treatments, and reduce the frequency of
adverse events.

Electronic Communication and Connectivity: Improved communication among doctors, providers and other partners, such as laboratory, pharmacy, and radiology professionals, can enhance patient safety and quality of care. Electronic communication tools, such as e-mail and web messaging, have been shown to be effective in facilitating communication both among providers and with patients, thus allowing for greater continuity of care.

Patient support: Tools that give patients access to their personal health records and provide interactive patient education, will encourage greater involvement of patients in their own health care.

Administrative processes: Computerized administrative tools, such as scheduling systems, would greatly improve practices’ efficiency and provide more timely service to patients.

Reporting: Electronic data storage that employs discreet data will enable health care organizations to respond more quickly to federal, state, and private reporting requirements, including those that support patient safety and monitor public health.

4 IDEOLOGY AND PURPOSES OF THE SYSTEM PROPOSED

The following factors, in priority order, are driving the need for Electronic Health Records in medical practices:

- Improve clinical processes or workflow efficiency
- Improve quality of care
- Improve clinical documentation to support appropriate billing service levels
- Share patient information among health care practitioners and professionals
- Reduce medical errors (improve patient safety)
- Provide access to patient records at remote locations
- Improve clinical data capture
- Establish a more efficient and effective information infrastructure as a competitive advantage
- Contain or reduce health care delivery costs
- Meet the requirements of legal, regulatory, or accreditation standards
- Facilitate clinical decision support

5 SOME ADVANTAGES OVER THE EXISTING SYSTEM

Potential Productivity and Financial Improvement
- Fewer chart pulls
- Improved efficiency of handling telephone messages and medication refills
- Improved billing
- Reduced transcription costs
- Increased formulary compliance and clearer prescriptions leading to fewer pharmacy call backs
- Improved coding of visits

Additional potential benefits may include:
- Technically, human-like systems integrate with consistent performances.
- Population management and proactive patient reminders through constant messages and emails.
- Improved reimbursement from payers due to EHR usage
- Participation in pay-for-performance programs.
- Expert system identifies the right medication for the ailments and updates the doctors with latest medicines in the market.

Quality of Care Improvement
- Easier preventive care leading to increased preventive care services
- Point-of-care decision support
- Rapid and remote access to patient information
- Easier chronic disease management
- Integration of evidence-based clinical guidelines

Job Satisfaction Improvement
- Fewer repetitive, tedious tasks
- Improved intra-office communication
- Access to patient information while on-call or at the hospital
- Easier compliance with regulations
- Demonstrable high-quality care

Customer Satisfaction Improvement
- Quick access to their records
- Reduced turn-around time for telephone messages and medication refills
- A more efficient office leads to improved care access for patients
- Improved continuity of care (fewer visits without the chart)
- Improved delivery of patient education materials

6 FUTURE EXTENSIONS AND ENHANCEMENTS

The future extensions and enhancements play a pivotal role in how this entire system is steered into the healthcare systems in the future.

Some of the interesting future enhancements include-

1. Chip Implantation

The process of implanting a chip is a new trend in the day to day processes. It not only enables to track a person from time to time but also identifies the exact match.

Individuals can be physically located by latitude, longitude, altitude, speed, and direction of movement.
Researchers at the Massachusetts Institute of Technology (MIT) and elsewhere have embarked on an ambitious $32 million “human body-on-a-chip” research project that will use micro-electro-mechanical systems (MEMS) microfluidics to mimic people's reactions to substances-of-interest. A pin code could be used to activate the chip – or to deactivate it to maintain privacy.

They are easy to install and remove, and, because they are implanted under the skin, they are unobtrusive. The chips, which could be the size of a thumbnail, could be injected into an arm or a hand.

GPS would not work because skin would block the signal, although new Near Field Communication chips like those in current smartphones could work because of their low-power requirement. However, no-one has yet tried to implant NFC chips.

2. Smart device access

The report can be universally acclaimed and accessed by the patient.

The updating of smart devices corresponds to the fact of using smart integration between scanning systems like an ECG scanner or X-ray machine, which can be integrated with the corresponding patients’ ID and updated online to his portal directly instead of a hard copy.

3. Expert systems linkage network

With the daily access of expert systems in the near future, there could be a separate network set up exclusively for all smart devices and expert systems in the future.

With that coming into existence, it is possible for the patient as well as the doctor to understand the patients’ case and symptoms wherever possible on the go, not only at a restricted clinic and medication can be prescribed through such a system then and there through smart communication for the patient for their quick recovery.

4. Governmental ID medications

It can be made a possibility in each nation that a valid governmental proof is produced before or during the course of medication for identity purposes and patients’ online portal update, that serves the purpose of national identity and authentication.

Each patient can then be contacted to their corresponding relatives through their emergency numbers saved online in case of any urgent or emergency situations.

7 OUR NATIONS’S ROLE IN THIS MEDICAL EXPERT SYSTEM

This system was first proposed in the United States of America in 2011 and in other western countries very recently, well known as Electronic Health Record, but does not cover the key aspects that are discussed below. These include the prime components such as-

- Universal Medication ID to each patient and its auto generation by usage of their personal number or Aadhar ID.
- Cloud based data storage and retrieval
- Intelligent medical tracker
- Intelligent dosage level identifier
- Report generation based on the corresponding disease/infection
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This is an entirely new concept to the Indian sub-continent and with the recent e-government practices brought in by our honorable Prime Minister of India, these developments are bound to be a source of bounty of opportunities especially in the way medical system and treatment records are produced and maintained in the Indian healthcare systems.

Hence it is the perfect time for bringing in the expert medical systems into India for the treatment, reports and service purposes. With all the enhancements proposed and with the future extensions that are made to be possible, India can lead the healthcare services provided to each patient improvising the medical standards all over.

8 CONCLUSION

An expert system in the field of medical sciences is a great stipulation that needs to be adhered in the future. With all the necessary requirements and advanced, yet balanced technological inputs we possess today, it is indeed a great step for mankind to promote the medical care utilities and systems present. With this ideology proposed it is undoubtedly the best human-like medical attention that can be given to treat the needy. Healthcare systems will definitely have a revolutionary change with this makeover that transforms the treatments and services offered to the best, from time to time with latest inputs and today’s technology.

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