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Development and Simulation of Medicine Prescription System to represent the Application of Expert system

Poonam Punia

Abstract: An Expert System is a computer program coded to simulate knowledge and behavior of an individual or an organization which is expert in some particular field, usually all expert systems contains a knowledge base which is accessible by a set of rules depending on specific situations. Among the number of expert systems the best examples of they can be named as Chess Game or the medical diagnosis expert systems. An expert system is divided into two sub-systems: inference engine and knowledge base. Knowledge base represents facts and rules. Inference engine applies rules to known facts to deduce new facts. Inference engines may also include explanation and debugging capabilities.

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Keyword: AI, Expert System, Inference Engine, Knowledge Base.

[1] Introduction

In artificial intelligence, an **expert system** is a computer system that emulates decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning about knowledge, represented primarily as if–then rules rather than through conventional procedural code. First expert systems were created in 1970s and then proliferated in 1980s.Expert systems were among first truly successful forms of AI software.

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Advantages

- The knowledge base can be updated and extended
- They can contain a large amount of information

Disadvantages

They are not able to learn from the mistakes

- They cannot creatively come with new solutions for the issues
- It's not easily achievable to mimic the exact knowledge of an Expert in Computer Programs

Components of an Expert System:

An Expert System contains of 3 components, which are

1. **User Interface**
2. **Inference Engine**
3. **Knowledge base**.

Expert System Components

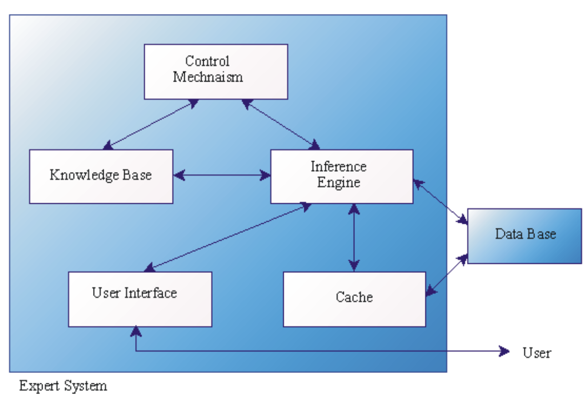

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Fig 1.

[2] PROPOSED RESEARCH WORK

The goal of knowledge-based systems is to make critical information required for system to work explicit rather than implicit. In a traditional computer program logic is embedded in code that may typically only be reviewed by an IT specialist.

With an expert system goal was to specify rules in a format that was intuitive and easily understood, reviewed, and even edited by domain experts rather than IT experts. benefits of this explicit knowledge representation were rapid development and ease of maintenance.

With an expert system shell it was possible to enter a few rules and have a prototype developed in days rather than months or year typically associated with complex IT projects.

Ease of maintenance is most obvious benefit. This was achieved in two ways. First, by removing need to write conventional code many of normal problems that may be caused by even small changes to a system could be avoided with expert systems. Essentially, logical flow of program (at least at highest level) was simply a given for system, simply invoke inference engine. This also was a reason for second benefit: rapid prototyping. A claim for expert system shells that was often made was that they removed need for trained programmers and that experts could develop systems themselves. In reality this was seldom if ever true. While rules for an expert system were more comprehensible than typical computer code they still had a formal syntax where a misplaced comma or other character could cause havoc as with any other computer language.

In addition, as expert systems moved from prototypes in lab to deployment in business world, issues of integration and maintenance became far more critical. Inevitably demands to integrate with and take advantage of large legacy databases and systems arose. To accomplish this integration required same skills as any other type of system.

[3] Literature Review

Edward Feigenbaum said that key insight of early expert systems was that "intelligent systems derive their power from knowledge they possess rather than from specific formalisms and inference schemes they use." Although, in retrospect, this seems a rather straightforward insight, it was a significant step forward at time. Until then, research had been focused on attempts to develop very general-purpose problem solvers such as those described by Newell and Simon.

Expert systems were introduced by Stanford Heuristic Programming Project led by Feigenbaum, who is sometimes referred to as "father of expert systems". Stanford researchers tried to identify domains where expertise was highly valued and complex, such as diagnosing infectious diseases (Mycin) and identifying unknown organic molecules (Dendral).

In addition to Feigenbaum key early contributors were Edward Shortliffe, Bruce Buchanan, and Randall Davis. Expert systems were among first truly successful forms of AI software.[4][5][6][7][8]

Research on expert systems was also active in France. In US focus tended to be on rule-based systems, first on systems hard coded on top of LISP programming environments and then on expert system shells developed by vendors such as Intellicorp. In France research focused more on systems developed in Prolog. Advantage of expert system shells was that they were somewhat easier for non-programmers to use. Advantage of Prolog environments was that they weren't focused only on IF-THEN rules. Prolog environments provided a much fuller realization of a complete First Order Logic environment.

In 1980s, expert systems proliferated. Universities offered expert system courses and two thirds of Fortune 1000 companies applied technology in daily business activities. Interest was international with Fifth Generation Computer Systems project in Japan and increased research funding in Europe.

In 1981 first IBM PC was introduced, with MS-DOS operating system. Imbalance between relatively powerful chips in highly affordable PC compared to much more expensive price of processing power in Mainframes that dominated corporate IT world at time created a whole new type of architecture for corporate computing known as Client-server model. Calculations and reasoning could be performed at a fraction of price of a mainframe using a PC. This model also enabled business units to bypass corporate IT departments and directly build their own applications. As a result, client server had a tremendous impact on expert systems market. Expert systems were already outliers in much of business world, requiring new skills that many IT departments did not have and were not eager to develop. They were a natural fit for new PC-based shells that promised to put application development into hands of end users and experts. Up until that point primary development environment for expert systems had been high end Lisp machines from Xerox, Symbolics and Texas Instruments. With rise of PC and client server computing vendors such as Intellicorp and Inference Corporation shifted their priorities to developing PC based tools. In addition new vendors often financed by Venture Capital started appearing regularly. These new vendors included Aion Corporation, Neuron Data, Exsys, and many others. In 1990s and beyond term "expert system" and idea of a standalone AI system mostly dropped from IT lexicon. There are two interpretations of this. One is that "expert systems failed": IT world moved on because expert systems didn't deliver on their over hyped promise. other is mirror opposite, that expert systems were simply victims of their success. As IT professionals grasped concepts such as rule engines such tools migrated from standalone tools for development of special purpose "expert" systems to one more tool that an IT professional has at their disposal. Many of leading major business application suite vendors such as SAP, Siebel, and Oracle integrated expert system capabilities into their suite of products as a way of specifying business logic. Rule engines are no longer simply for defining rules an expert would use but for any type of complex, volatile, and critical business logic. They often go hand in hand with business process automation and integration environments.

[4] HYPOTHESES /OBJECTIVE

The objective of research is to develop a MEDICINE PRESCRIPTION SYSTEM that is derivation of Electronic prescribing or ***e-prescribing***. Electronic prescribing is computer-based electronic generation, transmission and filling of a medical prescription, taking place of paper and faxed prescriptions. medicine prescription allows a physician, pharmacist, nurse practitioner, or physician assistant to electronically transmit a new prescription or renewal authorization to a community or mail-order pharmacy. It outlines ability to send error-free, accurate, and understandable prescriptions electronically from healthcare provider to pharmacy. medicine prescription is meant to reduce risks associated with traditional prescription script writing. It is also one of major reasons for push for electronic medical records. By sharing medical prescription information, medicine prescription seeks to connect patient's team of healthcare providers to facilitate knowledgeable decision making.

System must be capable of performing all of following functions:

- Generating a complete active medication list incorporating electronic data received from applicable drug plan.
- Selecting medications, printing prescriptions, electronically transmitting prescriptions, and conducting all safety checks using integrated decision support systems
- Providing information related to availability of lower cost, therapeutically appropriate alternatives
- Providing information on formulary or tiered formulary medications, patient eligibility, and authorization requirements received electronically from patient's drug plan
- Review patients' current medication list and medication history information within practice.
- Work with an existing medication within practice, this may involve viewing details of a medication, remove a medication from active medication list, change dose, etc., for a medication or renew one or more medications
- Prescribe or add new medication and select pharmacy where prescription will be filled.
- The information is then sent to Transaction Hub, where information on patient eligibility, formulary, and medication history/fill status is sent back to prescriber.
- Patient-specific information capabilities (e.g., current patient medication list, access to patient historical data, patient identification)
- System integration capabilities (e.g., connection with various databases,

connection with pharmacy and pharmacy benefit manager systems)

- Educational capabilities (e.g., patient education, provider feedback).

[5] CHALLENGES OF PROPOSED SYSTEM

Challenges and limitations that may hinder widespread adoption of medicine prescription practices are addressed below:

- Financial Cost and Return on Investment (ROI) - costs associated with purchasing, implementing, supporting and maintaining such a system may be beyond means of most small clinical practices, and noted to be one of greatest implementation barriers. Health care workers who are responsible for medical prescription, especially those in small practices, inner city areas, or remote rural settings, may bear more than their fair share of cost associated with medicine prescription. This is in response to various other stakeholders that may reap benefits from such a system, without having to financially support it, disseminating their risk substantially. Clinical practices therefore need to invest significantly in both hardware and software, with varying costs based on system specifications (stand alone system or entire EHR system). Even clinics that receive free medicine prescription systems may face financial costs pertaining to management of interface, customization due to flexibility, training, maintenance, and upgrades. On top of this, clinic must also take into consideration lost time and efficiency during transition period of implementation. As a result large urban areas may see greatest ROI when compared to those in rural or inner city locations.

- Change Management - Many underestimate challenges pertaining to change management when transitioning from paper-based prescriptions to medicine prescription. This is especially true in busy practices where healthcare providers and associated staff are accustomed to their current management system, in which case change management becomes extremely important. Building on this, many staff accustomed to certain work practices may have particular aversions to technology, and therefore, may be difficult to get everyone on board when introducing such a dramatic change. Analysis is needed to understand how to change workflow around management of prescriptions with introduction of an electronic system, which may prove to be difficult and time consuming. change also requires pharmacists to alter workflow and increase their awareness of new types of errors associated with e-prescribing, in order to best target their activities to reduce clinical risk. As a result, steps must be taken to ensure effective planning, training, support, and continuous quality improvement for successful transition.

- Hardware and software selection - Choosing right hardware platform and software applications can be a rather daunting task for practices, especially in regards to small and busy settings. Many have limited access to expert information technology personnel/staff, leading them to struggle with how to get started, appropriate vendor selection, cost and function negotiations, and most importantly, long term support to ensure continuous functionality and meaningful use. Once again, initiatives must be put into place to allow for effective and strategic planning prior to adoption.

- Erroneous alerts - inability to effectively use clinical decision support systems due to erroneous triggering of pop-up alerts with ill-defined software is also a great limitation. Under such circumstances, many opt to turn notifications off, disabling one of systems great beneficial aspects.

- Integrity of data input - Accidental data entry errors such as selecting wrong patient or clicking on wrong choice in a menu of dosages may occur. Software vendors should continually review user feedback and follow best practices in user interface design.

- Security and Privacy - As with many eHealth solutions, privacy of patient information stored in electronic format may lead to possibility of novel errors, such as inadvertently divulging protected health information on internet through inadequate security practices. Instances of negligence may also arise, where employees may forward prescriptions to organizations outside its intended use. Another security issue that needs to be addressed upfront is verification of electronic signatures, in ensuring medical integrity of prescriptions received by pharmacists. Therefore, Hospitals, clinics and pharmacies should be protected with firewalls, use strict computer permission settings, and remain vigilant toward signs of an intrusion.

System Downtime - Periods of system downtime may arise, either due to network-related issues, hardware failure, or loss of electricity. inability to use electronic prescribing when system is not accessible is of great concern, and must be addressed with discussion of fall-back procedures and mechanisms when such situations arise.

[6] Scope of proposed system

Proposed System will offers clinicians a powerful tool for safely and efficiently managing their patient's medications. Compared to paper-based prescribing, medicine prescription can enhance patient safety and medication compliance, improve prescribing accuracy and efficiency, and reduce health care costs through averted adverse drug events and substitution of less expensive drug alternatives. This is of key importance because in 2000, Institute of Medicine identified medication errors as most common type of medical error in health care, estimating that this leads to several thousand deaths each year. Proposed System will also has potential to improve beneficiary health outcomes. For providers who choose to invest in medicine prescription technology, adoption could improve quality and efficiency and could show promise in reducing costs by actively promoting appropriate drug usage; providing information to providers and dispensers about formulary-based drug coverage, including formulary alternatives and co-pay information; and speeding up process of renewing medications. Proposed System may play a significant role in efforts to reduce incidence of drug diversion by alerting providers and pharmacists of duplicative prescriptions for controlled substances.

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