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Review Article

Create Frameworks from Software Engineering to Health Care: A Survey

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ABSTRACT

Background & Aims: One of the challenges of multidisciplinary disciplines such as Medical Informatics, Health Information Technology, etc., especially for those who have just begun research in this field, is the lack of familiarity with some of the key terms and applications of software concepts, including frameworks.
Methods: This study is based on search of databases (ProQuest, PubMed, Google Scholar, Science Direct, Scopus, IranMedex, Irandoc, Magiran, Pars Medline and Scientific Information Database (SID)). This investigation has done with the websites and the specialized books with standard key words. After a careful study, 56 sources were selected and used in the final article.
Results: Frameworks are widely used in the field of health care and have produced valuable results. Considering the framework advantages in the health care sector among designing and estimating the systems in standard ways and comparing the systems in principle for identifying the gaps and introducing the capabilities, avoidance of reworking seem necessary. Therefore, after reviewing the literature we will explain about meaning, overlapping to the other meanings, components, steps, advantages, challenges, and the types of frameworks in general and their applications in the healthcare sector.
Conclusions: The results of this research can help the researchers for doing the new research and understand the important concepts of that, thus it can be useful in designing and researching projects for researchers and health care providers as well.

Introduction

One of the interdisciplinary challenges (multidisciplinary) such as medical informatics, health information management, health information technology, etc. especially for beginners and people who have begun research and investigation, is lack of familiarity with some terms and important usage of software concepts and systems engineering. For example medical informatics major is an interdisciplinary discipline that benefits from computer science and software, information science, medical, statistics, mathematics and cognitive sciences. Its task is using concepts, tools, methods, software techniques and modeling to improve health care services, reduction of costs and care errors [1-4]. One of the concepts that is widely used in computer engineering is the framework. This concept has been considered in the district of

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skin care in recent years [5-10] Framework has lots of advantages including in the planning of standard systems and their estimate comparison of system of different countries, identify gaps and capabilities [11]. The important point of framework is understanding concepts, planning process. In this way we can use the valuable plan results many items and benefits by high capabilities. Therefore after reviewing the literature, we will review the concepts and definitions, overlap with other concepts, components, steps, advantages, challenges, types and framework applications.

What is framework?

Framework is a concept of tools or process [12]. In fact it is including, enclosing and could keep the structure [13]. It is designed as a template or pre-made template and manage common and duplicate features. In the other words, the framework is a basic conceptual structure that is used for solution and attention to the complex issues and it's usually set of tools, materials or components [14]. This phrase has come from the world of architecture to the world of software and then management. In computer science, a framework is a set of tools, libraries, contracts, supported programs, apps, compilers, tools and application programming interfaces (APIs). It's founded for one or some programming language and makes it easier such as «Microsoft .Net framework» that it is considered for «Visual Studio», «#C», «Basic» and even «C++». It contains thousands little libraries with rules and tools for developing a software, a process or a system. By using the framework, general features of a software can be changed selectively by adding written codes by the user. As a result, a software is made with a special application. Software framework raise a standard way for making and development of the applied programs. Software framework is comprehensive and reusable. Concepts required for designing a framework [15].

Dimension

To implement a concept, first you should determine its constituent dimensions. Most of the concepts have different aspects that should be considered. For example you can introduce deprivation in political, social, economic, psychological or physical dimensions [16].

Component

The hypothesis of a one or some dimensions. For example you can review the causes of academic achievement individually and socially. All of these turn into smaller elements to be measurable and verifiable. Then on the basis of these dimensions and components you can design a conceptual framework and model [16].

Indicator

The concepts should have had empirical indicators for using. The indicators are the identified objective signs and measurable dimensions of the concept [16].

Theory

Theory in term of composition and structure, is a set of concepts, hypothesis, and rules. These components are mutually related and explain a reality or phenomenon regularly. Theory is a point of movement or tracking the research issue and it helps to make a research.

The theories generally divide to two groups:

1. Explanatory theories: These theories are the subject of science. Actually they claim that they can explain the reality and facts.
2. Prescriptive and recommended theories: Usually these theories have political and social nature. They may present on the basis of some belief defaults, cultural, political and even scientific [17].

The difference between Model and Theory

The models are more abstract that the theories and present the general idea and public phenomenon of a study. The theories are more accurate, more dedicated, containing defined and clear concepts. The concepts of theory and model are very close together. There is a close link between these concepts. So we need to discuss about the differences between two concepts:

1. At least there is a model in every theory.
2. The theory consists of the relationship that is deducted from a model.
3. Model is a mechanism that can help us to understand how and on what basis of the sequence and logic sequence, the various components of a theory are connected together, but a theory try to find out the cause of a phenomenon and event and why a phenomenon has happened [18].

The difference between Model and Pattern

1. The word «Model» is a little more complicated than the word «Pattern». Pattern pay more attention to the structure and connection between the elements of a reality. It's a simplified design that specify the basis lines of a social collective and available connections between them. The word «Pattern» regulates the elements of that phenomenon and creates order to make the phenomenon easier and understandable and make it into a logic design and a figure as well.
2. Model is a set of material, mathematics or logic. Model is a little ingredient with miniaturized reconstruction of a thing or a big phenomenon that it is the same in the function with that thing or the real phenomenon [18].

The differences between theory and pattern

Theory specify the social affairs immediate and direct, without referring to the template, but pattern helps to know the reality through similarity and by highlighting the similarity elements, it makes a clearer understanding of the similarity between reality and the mental model[19].

Paradigm

Paradigm is a dominant pattern and model, intellectual and cultural framework. It's formed the collection of patterns and theories for a group or a society. Each group or society analyzes and describes around realities in paradigm framework that is accustomed to it. Kuhn in (the structure of scientific revolution) defines scientific paradigm:

- What is observed and scrutinized.
- The types of questions asked and checking out the connection of the answers to the subject.
- How to structure these questions.
- How to interpret the scientific research results.
- How to execute and conduct the experiential studies and the available

equipment for executing experiential study [20].

Platform and framework concept

Platform and framework are the two all-purpose concepts sometimes they used in place of each other in wrong ways. While each has a special meaning and concept. Actually platform is a place that the written software programs are executed and used in it. It contains hardware requirements such as type of system and CPU (Central Processing Unit), and software requirements such as operating system. For example applications and games are not applicable without personal computers (PS), cellphones, laptops, video game consoles etc. The hardware and any program in a particular operating system is applicable, even under a specific version. The software that we call them platform such as windows XP G4 Bit platform, windows 10 platform, windows mobile platform, Linux platform, Android platform, Java platform, PC platform, XBOX platform, etc. Software framework is a capability that usually gets help from manuals, libraries, user interface and classes. Generally the provided facilities from a software or a programming language make a new structure to make it easier for using that software or programming language. The result is that in the world of software, the frameworks create on the platforms [16, 18].

Framework applications

- Improvement and re-engineering of processes and services.
- Design and system productions
- Design / organizational architecture overview
- Integration of systems and E-services
- Design of services and new products [21].

What are the advantages of the framework? What is the need for its design?

In most cases the framework advantages are more than disadvantages, such as reducing development time, increasing extensibility, writing at once and executing several times. These are very important economically. The other advantages are more simplicity, better result high efficiency, integration capability, better labor market, being professional, higher security, update facility, upgrading the app, foster coding, reusable of written codes, open source, doing teamwork[22,23]. Software framework contains frozen spots and hot spots [24]. The frozen spots define the overall architecture of a software system, basic components and the relations between them. These spots stay unchanged (frozen) in all types of frameworks. The hot spots show the parts that the user programmers of framework can add their code to enhance and expand the specific capabilities to their project. For creating a software system by a software framework, the developers use the hot spots due to the special needs and system requirements.

Types of frameworks

Theatrical framework

Theatrical framework addresses the relationship between variables such as independent, dependent, interfering and convertor variables. Making a theatrical framework helps to establish and structure of hypotheses, test them and complete understanding of researcher. Generally the theatrical framework is the basis that all

research rely on it. There is a logical, developed, described and exhaustive network between the variables that are specified by processes such as interview, observation, review the subject literature and background research. These variables are related to the research issue.

There must be 5 essential features in each theatrical framework:

1. Research variables should identify and name clearly.
2. In a research, the relation between two or more dependent and independent variables should be expressed.
3. If it is possible to express the nature of the relationship on the basis of the findings from previous research, then there should be a sign of the positive or negative of these relationships in discussions.
4. We must use the previous research findings to answer the question why we expect these relationships to exist.
5. A schematic diagram of the theatrical framework (analytical model) should be presented so that the reader can visualize and present theatrical relations [16].

Conceptual framework

Concept is the name used to describe a phenomenon or group of phenomena. Therefore, when we name a phenomenon, it changes to a concept. The conceptual framework is a collection of general goals and correlative basics that determine overall and special goals and defines the basics and concepts for achieving these goals. These concepts are guidance for choosing the events, deals and conditions that must be considered and guided for recognition measurement, abbreviation and reporting [25-27].

Conceptual framework objectives:

1. Describing concepts and suggested relationships among concepts.
2. Providing background for the interpretation of study findings.
3. Description of observations
4. Encourage to create a theory

After determining perceptual framework, the model will be designed. The framework of that design and map is raw. When a model us made of that design and framework, the defects, problems, the weak and strong points of the perceptual framework will be determined or so-called cooked [27].

The differences between theatrical and conceptual framework:

Theatrical framework are commonly used in quantitative research, while the researcher uses a theory or combination of several theories for preparing a map and explaining research hypotheses.

Conceptual frameworks are commonly used in qualitative researches, while a researcher uses the analysis and categorization of previous research findings as a map for designing tools and operational research questions [27].

Software framework or practical

Software frameworks included a significant amount of preparation code and applications to help boot programs, but they generally focus on specific districts such as artistic painting, composing and CAD (Computer-Aided Diagnosis) mechanic. Modeling programs, Earth system modeling program, decision support systems, broadcast publish media, web framework, firmware, high performance scientific computing framework, applied framework, general programs GUI (Graphical User Interface),

commercial architecture framework[28-32,22,23].

MVC (Model - View- Controller) structure in frameworks

Usually, software frameworks are designed based on the MVC programming pattern. MVC divides the software into three parts: Model, View and Controller. It is a term used when working with the frameworks. Of course it cannot be said that those objects that were not made according to the MVC are not frameworks [33]. In MVC programming, the View part handles the display of information to the user. The Controller part gets the information from the user and process them. The Model part also performs data storage and retrieval. Content management systems can be considered as a kind of framework, but in the programming world, the term « Platform » is a better choice for content management systems because the framework helps developers to develop their works, but usually the programmers help platforms to be developed. Generally, portals and content management systems such as Joomla, Mambo, WordPress, etc. [34-38], ultimately become a library or framework. Here it is necessary to provide an explanation about the architecture; one of the main issues in the development of modern software system is their quality. So far, different architectures for designing and implementing software have been presented proportional to the growth of technology in the software sector. On the one hand, these architectures are based on the features and nature of the hardware architecture, and on the other hand, depending on the type and attitude of the software engineering technologies and user-designed expectations. Each architecture has unique features, and software that is relying on each of these architecture and then execute. These soft wares will inherit its own characteristics from the architecture used. The examples of various architectures are: Mainframe architecture, File Server architecture, Client / Server architecture, dual layer architecture, multilayered architecture, service oriented architecture, data oriented architecture [39].

Operational framework

The operational framework includes guiding principles, related features and life-cycle process that is applicable to process owners, project leaders, managers, individuals leading change and other staffs. It has methodological nature and provides specific criterion, user, steps, methods, depending on the purpose and a guidance for company politics, goals, standards, procedures and trainings [40].

The steps to create a framework:

In the software framework, the steps include design, implementation, testing, documenting, use and evolution and maintenance [5].

To create a conceptual framework, choose the subject you are specialized in, review the literatures, extract the variables and combine them from different studies. This framework is a question that has not been addressed in other studies or consider a gap in knowledge [41, 42].

To create a theatrical framework, the following steps should be considered:

1. Specify the problem or topic
2. Specify the variables associated with the subject.
3. Conduct extensive texts

4. Specify the theory for communicating variables [43-46].

   Get the connection between theory and research operational framework describes as a general corporate organization or management structure. It includes how the leaders govern the company and perform its hierarchy of divisions or management teams. Outline policies include the company. It can include a guide to the principles of behavior, recruitment and propagation [40].

Difficulties and challenges of framework

- Need for time**:** most developers often need more time to learn how to work with the framework.
- Most profit efforts: there are always people who copy the designs of others and do it easily.
- Lack of familiarity with all the elements used.
- When using the framework naturally, many of the preset items may not be easily understood by the user, and the user probably does not want to learn them, and it's just the user.
- Inheriting other errors: no frameworks are the best and no plans are the top plans. There may be problems inherited by use [22, 23].

Samples of a variety of healthcare frameworks

In the field of health care, conceptual frameworks for performance of the public health, organizational performance of health care, quality of care, e-health assessment are presented [6-8, 47-49].

In a study, a theoretical framework for coordination care in chronic diseases requiring long-term care was presented [50]. In a study, the presentation of a theoretical framework for Public Health Ethics was presented [9]. A proposed operational framework for injury risk management was presented [51]. Also, a community-based care for mothers and infants in Queensland, in the form of an Operational framework and in the form of roles and aspects required [52]. In a study using framework statistical techniques to suggest a drug to diabetic patients [53]. In a study a framework was developed to determine benign or malignant breast cancer [10]. In a study using probabilistic methods, a framework was developed that processed mammography images for cancer diagnosis [54]. In a framework study, the Bayesian method was used to determine variations in EEG / FMRI [55].

Conclusion

In this article, the concept of frameworks survey, a familiar concept in software engineering, is described for the importance and benefits of health care. The design of the framework has many advantages, including the possibility of evaluating and comparing systems in a standard way, and avoiding many redundant design issues, allowing further development of the system. Many frameworks have been designed in the form of a variety of conceptual, theoretical, software and operational frameworks, especially in the healthcare sector in the last decade. It is recommended that a future review of a comprehensive overview of the uses of each type in the field of health be presented. It is recommended that future studies provide an overview of the comprehensive categorization of applications of any kind in the field of health to identify areas that are not already provided in the framework and provide a suitable framework for it or use design frames. It is also recommended that other software engineering capabilities be used to improve care services and describe the related concepts. The most widely used tools for system engineering in a wide range of

applications, including system design tools, simulation and modeling, statistical process control, management tools, human factors engineering, risk analysis and financial engineering tools, knowledge discovery in databases for health care advancement has promoted issues such as quality, efficiency, safety, and customer-centric processes, services and products. Operationally, it can be used for colonists, care teams, and managers to improve the efficiency of processes, units and care departments [56]. The results of this study can help researchers in the field of new research and understanding of the concepts of that field and can contribute to the useful, scientific and effective design of research projects of researchers and health care providers.

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