

# Applying Agile Software Engineering On Medical Ubiquitous Computing (MUC)

Mohammed N. Nazli<sup>1</sup>, Dr. Wael Al Sarraj<sup>2</sup>

<sup>1</sup> Faculty of Information Technology, Islamic University of Gaza - Palestine

<sup>2</sup> Faculty of Information Technology, Islamic University of Gaza - Palestine

**Abstract** - Nowadays, people are involved in using computation capabilities to meet their daily life needs although most of the time they may be unaware as to how this actually happens. Ubiquities Computing is considered the future trend for providing unlimited computing capabilities that handle every service in human life. One of the most crucial implementation of Ubiquities Computing is in Medical and Hospital Service. This is due to their great importance in saving people's lives. The huge amount of data and information delivered by MUC systems draw the attention to the necessity of having a new and modern software engineering methodology; Agile Software engineering methodology is highly considered in the matter. In this paper, we present an implementation of applying agile SWE methodology on MUC System, research related issues are also discussed.

**Key Words:** Pervasive Computing, Medical Ubiquities Computing, Agile Software Engineering, Ubiquities Computing, e-Health Systems.

## 1.INTRODUCTION

Computing is the process of utilizing computer technology to complete a task. it may involve computer hardware and/or software, but must involve some form of a computer system. Most individuals use some form of computing every day whether they realize it or not. Swiping a debit card, sending an email, or using a cell phone can all be considered forms of computing.

Ubiquities Computing (also called Pervasive Computing) is a new, modern and a very interesting for the IT researchers, its talking about to have a new smart technology to break out the traditional concept of computing systems [2], the main concept for the Ubiquities Computing is to make every appliance in your environment to be a hidden computer that can interact with each other to perform every life activities using an interactive user interface (Fig 1: describe this concept), this concept can be applied in medical field for patients and doctors (as you can find Fig 2, Fig 3 and Fig 4) or in education for students and teachers or in any other field. It made the computing to be appear in anytime and

everywhere but with a hidden computers using transparency [1].  
The Ubiquities Computing can occur using any device, in any location with any format, its terminals and devices could be sensors, tables, cameras, laptops or any other devices.



Fig 1: The main concept of pervasive computing [1].

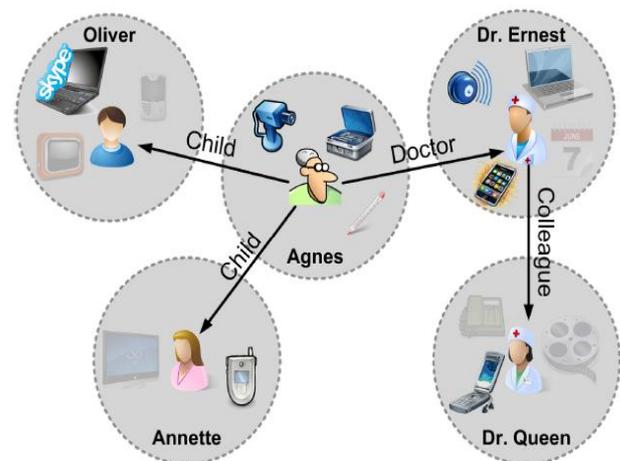


Fig 2: The concept of use pervasive computing in medical field [1].



Fig 3: The left-hand side showing the interactive bed and the right-hand side showing a remote radiology conference on a wall-sized interactive display [6].

Tool Kit Design	Transparency, Invisibility
Software Structuring	Mobility
Component Integration	Interoperability
Scalability, Extensability	Programming Framework
Context Awareness and Management	Customizability
Resource Allocation	Reliability

Table 1: software engineering challenges for ubi-comp [2].

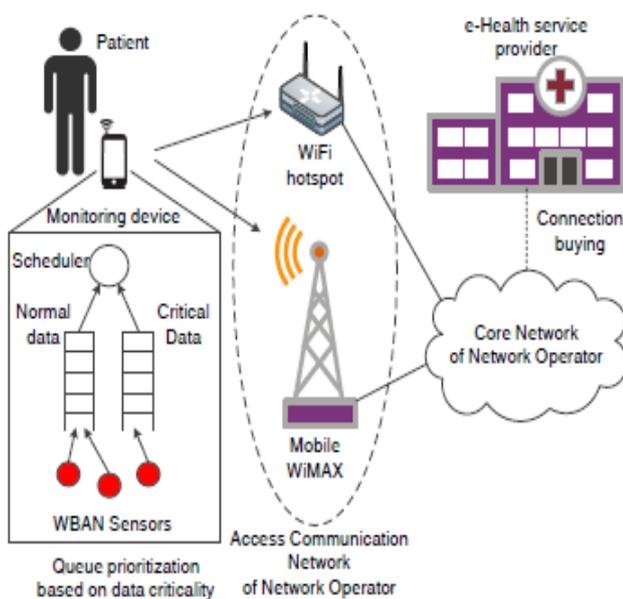


Fig 4: e-health care system architecture [12].

To develop such systems and make this vision completed we have to involve software engineering (SWE) so it can play a major role in building ubiquities computing software, but there is a big lack in selecting the best software engineering methodology for this systems this because ubiquities software structure is different from any other systems and there are a major challenges for those such software.

Depending on a previous survey to determine the software engineering challenges for ubi-comp, those challenges are listed below Some of these challenges have been addressed with some tentative proposed solutions but most of them still lack a proper solution and are yet to be addressed [2].

Agile software engineering is an adaptive methodology that can be applied on any other systems development process, In software application development, agile software development (ASD) is a methodology for the creative process that anticipates the need for flexibility and applies a level of pragmatism into the delivery of the finished product (see fig 4) [3]. Agile software development focuses on keeping code simple, testing often, and delivering functional bits of the application as soon as they're ready. The goal of ASD is to build upon small client-approved parts as the project progresses, as opposed to delivering one large application at the end of the project [3].

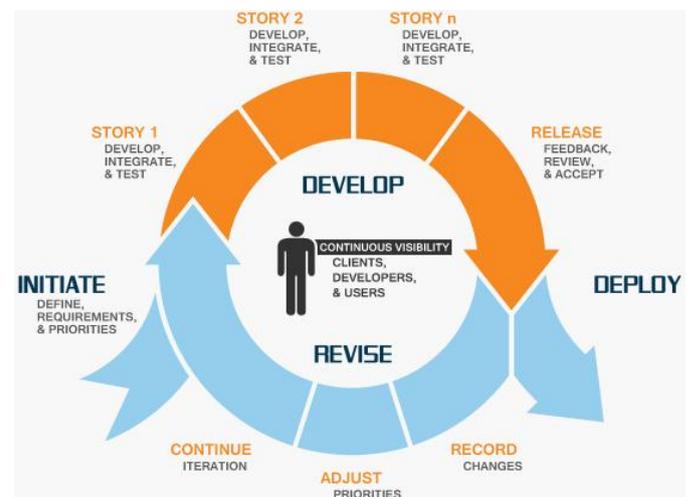


Fig 5: The Agile Process [13].

From our experience and study of various agile methods, we have written about 10 key principles of agile. These are characteristics that are common to all agile methods and very suitable for the medical Ubiquities Computing and the things that we think make agile fundamentally different to a more traditional waterfall approach to software development [3]. They are:

1. Active user involvement is imperative.
2. The team must be empowered to make decisions.
3. Requirements evolve but the timescale is fixed.
4. Capture requirements at a high level; lightweight & visual.
5. Develop small, incremental releases and iterate.
6. Focus on frequent delivery of products.
7. Complete each feature before moving on to the next.
8. Testing is integrated throughout the project lifecycle.
9. Deliver a high quality system.

The research Problem is selecting the best Software Engineering methodology to be used to develop a Medical Ubiquities System.

We have conducted a deep research view on the characteristics of Agile Software engineering methodology and the characteristics of MUC systems, we find that agile can be very suitable to develop such systems.

So, we are introducing Agile as the best software engineering methodology for Medical Pervasive Computing depend on the system characteristics and needs that we list to make this system development process to be accomplished, in section II we are giving an overview of a previous related works, in section III we introduce our approach for this research, Finally section IV contain the conclusion.

## II. Related Works

Medical Ubiquities Systems is a new field in research, but there are many of researchers discuss that field with a deep view on the technical issues and its structure, but a few of them have a look on this field from software engineering view, in this section we introduce some of these previous researches.

- a. Rapid Prototyping for Ubiquitous Computing (UC) in Health Care Real Life Settings, for Andreas Holzinger, Klaus Schwabinger, Matthias Weitlaner

The authors developed prototypes with the aim of raising awareness and to gain insight into medical workflows and tested their prototypes in real-life medical settings within Graz University Hospital – which is amongst the largest in Europe [9].

Regarding the use of Rapid Prototyping for UC, It is a generally known fact that many software developers rarely use Usability Engineering Methods (UEM) on software development projects in their work and it is seldom that projects adopt a fully integrated User-Centered Development (UCD) approach in one strategic shift. This includes early focus on the end user, empirical studies and iterative development of prototypes [9].

In this project the authors involved the end-users early in the design and applied a range of Usability Engineering Methods, which perfectly fit together with rapid prototyping techniques.

- b. Hospitals of the Future – Ubiquitous Computing support for Medical Work in Hospitals, Jakob E. Bardram

This paper describes the visions and on-going research within creating ubiquitous computing support for medical work in the hospitals of the future. Today, clinical computer systems seldom play any role in the execution of clinical work as such [6]. Electronic Patient Records (EPR) are more often located in offices at a hospital rather than at patients' bedside, or in operating theaters. There are a number of challenges to the hardware and software design of contemporary computer systems that make them unsuitable for clinical work. It is, for example, difficult to operate a keyboard and a mouse while operating a patient [6].

This research assume that UMC have these infrastructure characteristics:

- Collection of services
- Secure
- Context Aware
- Collaboration

- c. Software Engineering Challenges for Ubiquitous Computing in Various Applications

In this paper, authors have made a survey of various ubi-comp applications and extracted a number of software engineering challenges faced by other researchers during the development of such applications. This work provides a future direction for other researchers and developers to make the process of providing an appropriate framework for building ubi-comp application more effectively [2].

Some of these challenges are the fundamental requirements for an ubi-comp system as follows (see table 1).

As a Conclusion for those previous related work, we think those studies gave me a deep view in medical Ubiquities Computing and its structure and challenges and allow me to conduct an investigation research to determine the best software engineering methodology.

## III. Proposed Approach

Firstly, we have to understand the Medical pervasive system characteristics and requirements this could be helpful in selecting the best software engineering approach for that systems, so medical pervasive system specifications could be

the same of any other pervasive system in addition to QoS and Security issues.

In this section, we list the most important characteristics for Medical Pervasive System that could intersect with agile system development methodology:

Characteristic	Description
Improved quality	For such systems we need to be in highly sure that this system is in high quality, this because of this system is a medical system and need to get 100% for the quality.
Transparency	One of the most important thing is to make the project less cumbersome in the development process by explicitly communicate functionality costs and development times.
Collaborative Effort	Surly, for each development process you need to make an collaborative effort between the system development team.
User involvement	The user have to be involved and this is very important to have a good and successful software development process.
Adaptability	Medical Pervasive Systems have to be adaptive to fit new environment and new components.
Extendibility	MUC must have the ability to extend with a new functionality.

All of those characteristics can be intersected between Agile SWE methodology and MUC System development, as illustrated in Fig 5.

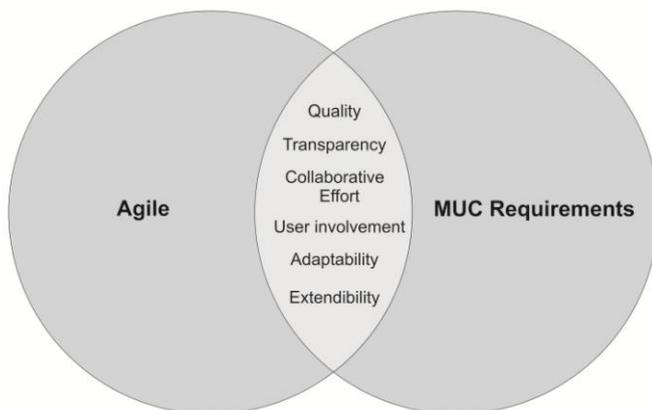


Fig 5: MUC Requirements and Agile Intersected specification

Agile software engineering is the most suitable SWE methodology for MUC because

- its support its characteristics and special design and development's needs,
- also because it's allow the user to be 100% involved in the development process

- and Emphasizes the importance of accuracy and quality for the product all of these with-in a team work environment,
  - instead of any another SWE methodologies that does not support iterative process and does not support user involvement or prototyping,
- So agile have the best advantages of those SWE methodologies.

But there are some big challenges in applying agile in MUC Systems:

1. For bigger and complex MUC Systems it will be hard to estimate the effort at the beginning of the development life cycle.
2. The cost can be increased.
3. Agile can be Intense for the development team.
4. Also for Designing and Documentation, agile methodology pays less importance.
5. If the MUC client is unclear about his requirements, there is a chance for messing up the project.

#### IV. CONCLUSIONS

As a conclusion, we emphasize that medical ubiquitous computing will bring simplicity to our daily lives and it will play a major role in saving more lives, for that reason we have to develop these such system with the most effective and the best suitable software engineering methodology, we made a survey in the most effective software engineering methodologies to explore its characteristics and specifications also we conduct a deep research on medical ubiquitous computing and we found that agile is the most suitable SWE methodology for medical ubiquitous systems and this depend on the matching between agile and medical ubiquitous systems characteristics, this essay can be very useful for researcher in the field of e-health care systems and medical ubiquitous computing systems.

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