Towards Handover Framework for Model Driven Web Engineering (MDWE) Approaches

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Abstract

Model driven web engineering (MDWE) methodologies considered as the mature solutions to buildings this kind of applications. MDWE methodologies are famous for increase productivity while building this kind of applications. Agile development methodologies are now considered as industry standard for development of web applications. MockupDD (Stand for mockup driven development) is hybrid of MDWE and well known agile practices. Mockups facilitate MDWE process in adaptation of agile well known practices in model driven process and leads toward reduction of development lifecycle. These methodologies also face some challenges related to project documentation, release planning and maintenance. These challenges are directly related to poor handover process. Handover is the process of transferring responsibilities from one party to another. A smooth handover process is critical to avoid problem which can occur in future. There is need to be investigate more this research area because not too much work is done in this area. The main objective of this research paper is to show the need of handover process model and provides a framework for smooth handover process for mockupDD. We compare our proposed model with existing models and results shows that over proposed model fully support the handover process lifecycle as compared to other models.

1. Introduction

With the growing use of internet, the web based applications increasingly become central to every aspect of life. From the past 20 years the web has grown into a global environment addressing the web application from simple and small scale applications to large scale and complex application. Now a large scale and complex web based business applications are developed for enterprises and organizations to run their business processes [1].

Web engineering a new emerging engineering discipline is the result of the growing importance of development of web based applications from the last few years. It is defined as: “the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of web based applications or the application of engineering to web based software” [2].

This definition of web engineering is quite similar to the IEEE Std. 610.12-1990 provided definition of software engineering: “the application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software” [3].

It can be seen that the nature of web application are quite different than the other desktop applications, So it is found that we cannot directly use software engineering models form the development of web based applications. The conventional software engineering models are adapted and made compatible for the successful development and maintenance of web applications [4].

Model Driven Web Engineering (MDWE) Methodologies like OOHDM, NDT, WebML, OOH4RIA, RUX-Method, WSDM and UWE etc. [5][6][7] are proved as mature solutions for the development and maintenance of web applications. These approaches develop web applications from the models describing at different level of abstractions [8]. These approaches have drawback of early and quick customer feedback [9].

Mockup Driven Development is a model driven web engineering approach. It is hybrid of model driven web engineering and agile software development process approach. In MockupDD scrum activates are applied on model driven web engineering methodologies [10].

Agile development methodologies are now increasingly becoming the industry standards for the development of web applications. These are now considers as the common applications failure remedying [11]. It is known that model driven web engineering approaches significantly increase the productivity [12].

Scrum is the method of agile development methodology. It is an iterative and incremental development framework. It emphasis on the cross functional teams which works in a short development bursts called “Sprints” to produce a working increment of product [11].

The software closing process is as much important as its initiation process is considered. A lot of money is invested for a software system. From the evidences it can be seen that the major portion of the project budget is consumed in the development process, less portion is consumed in the opening and closing process of projects [13]. A major portion of project budget is used in maintenance process if the project is not properly designed and developed [11].

Handover or transition is a process of transferring/delivering a software system from the development organization or team to maintenance organization or team [14][15][16]. In general we can say that the development organization transfer the developed system and its related data, transferring the
responsibilities related to system and transfer of system knowledge and experience required for this newly developed system [17].

Handover process is a critical phase of software development life cycle. We cannot isolate it from the other software development life cycles activities. These activities are highly related to the other SDLC activities such as the activities of pre-delivery development and the post-delivery evaluation and maintenance [17]. Every development organization use handover process to transfer software system from development to maintenance in some way or the other.

A successful transition process is necessary for the success of any software system. If transitions process is performed well it can save the major portion of project budget. The success of transition or handover process is highly dependent on the teams or parties involving in this process [18].

Even though the highly importance of handover process, a very little attention is paid to this research area. Small amount of efforts are done in this area [19]. The early presented model are either too old or these are too generic models. So these early model are not suitable for the new development methodologies like as model driven web engineering. Hence there is a clear need for a new handover framework for model driven web engineering methodologies which supports the successful transitions of web based systems.

2. Related Work

Even though handover is highly important phase of software development lifecycle but a very little effort can be seen in this research area. This area of research is still uncovered. We find only few handover process model designed for transition process from research. These found transitions models are very old or too generic models. These models are not suitable for the new developing methodologies like mockup driven development, which is hybrid model of model driven development and scrum activities [1].

We have found only four handover process models from the research performed in this research area. These identified transition model are presented in [2][3][4]. One specific handover process model is also developed for specifically for mid-sized organization [5]. Another model for software handover is presented by khan [6]. Model presented by khan is a general model and it provides the general guideline for the successful transition of software system.

By investigating the area of handover process we also find a taxonomy of handover. In this taxonomy the author provides the activities involved in handover process. The handover taxonomy is describe in this publication [7].

The publications [1][7][4] presents the transition process in general context. In these publications the handover process is divided in different phases. In these publications the general overall flow of handover activities with respect to its related phases are also provided.

We done too much effort in the research area of handover process, but still we couldn’t be able to find any publication that describe the successful handover process for the development and maintenance of model driven web engineering methodologies like as mockup driven development. Which is a hybrid of model driven development and scrum methodology. However we have found some publications that describe the evaluation, maintenance and release process for agile development process [8][9].

Research in the field of handover process shows that the researcher divide the overall handover process in three different phases. These three phase are as follows, pre-delivery handover, transition, and post-delivery handover [2][3][6][7]. Figure 1 given bellows shows the basic handover phases. Here the transition is the elementary handover to transfer a developed system and system related set of responsibilities from developers to maintainers. However this process is strongly dependent on the organization description of the maintenance processes [2].

![Figure 1: Software Handover Phases](image-url)

It is essential for the organization conducting the handover process to actively participate for the smooth and successful handover process. The smooth and successful handover process is very essential for future maintenance process. The reason is that the future maintenance strongly depends on successful handover of the system [10]. Development organizations face many
challenges while performing a software handover process. These challenges are insufficient system knowledge [2][1], lack of domain knowledge [2][1], insufficient communication [2][1], inadequate documentation [2][1], difficulties in tracking changes [2][1], lack of training [2][5] and knowledge sharing [2][5]. The above discussion shows that during handover process the organization face many serious challenges related to handover process. So there is need of a handover framework or model to resolve these issues. The initial taxonomy presented in [11] provides the base for formulation of handover framework or model. Figure 2 shows the seven basic activities of handover process. These are the activities that are given in the initial taxonomy [7]. These seven basic taxonomy activities are logically related to each other.

![Figure 2: Taxonomy Activities of Handover Process](image)

### 3. Proposed Framework

The Model driven web engineering methodologies are claimed to have a positive impact on the web development. It is stated that these methodologies are the mature solution for web development [12]. Model driven web engineering methodologies claimed that these methodologies increase software productivity and satisfaction [13]. Mockup driven development is a new methodology of model driven web engineering. It is a hybrid of model driven development and scrum methodology. Model driven development methodologies are claimed to increase productivity while developing web applications. On the other hand agile methodologies are considered to be the industry standard for the development of web applications [14]. The mockup driven development framework presented in publication [14] is shown below in figure 3. The workflow of mockup DD methodology with its iteration and technical steps is shown below in figure 4.

![Figure 3: Scrum vs. Mockup Driven Development Process](image)
As we describe above the mockup driven development is hybrid framework of model driven development and Scrum. Scrum process with its numerous advantages have some challenges as Scrum ceremonies, lack of documentation and release process [2]. These challenges closely related to poor handover process. These challenges may lead to increase maintenance cost. The identified challenges can be resolved by implementing a proper handover process. Proper handover process include release planning, proper documentation and proper communication which is required to transfer the system from development organization to maintenance organization. This shows the strong need for a perfect handover process for mockup DD.

After the need identification of a handover framework for the mockup DD methodology. The handover framework formulation for mockup DD is started. The handover framework for mockup DD formulation process consist of these 5 steps.

1. **Handover Process Phases Division**
   In first step the handover process is divided into three process phases pre-delivery, transition and post-delivery, as described by the khan in [7]

2. **Activities Identification**
   After dividing the handover process into three phases the process of activities identification is performed. In this step the activities which are performed in each phase of handover process phase are identified. These activities
are further classified into three categories as given bellow,

- Management Activities
- Development Activities
- Handover Activities.

The activities division according to each phase of handover process is shown below in figure 5.

3. Stakeholders Identification

In this step the stakeholders are identified which take part in any of the handover process phase activity.

4. Activity Assignment

When the activities and stakeholders related to any handover process phase are identified, then in this step the identified activities are assign to stakeholder.

5. Artifacts Identification

In this step the software artifacts related to any activity of handover process phases are identified.

The final proposed handover framework for mockup DD with handover process phase’s division, activities division, roles and software artifacts is given in figure 6.

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Figure 5: Activities Division in Each Handover Process Phase
According to the proposed handover framework shown in figure 6, product owner take parts in some management and development activates with scrum master and development team. Scrum master and his team are responsible for scrum activities related to management and development activities in addition with three handover activities related to the pre-delivery handover process phase. Scrum master is responsible of management and administration and maintenance planning activities. In this phase scrum master with its team is also responsible for software documentation.

Software artifacts of this handover process phase are mention with his related activity. In transition phase the product owner with scrum master and his team are responsible for iteration completion and maintenance environment activates. Scrum master and his team are responsible of deployment and documentation activities of this handover process phase. Scrum master is also responsible of iteration release planning. Software artifacts of transition phase are mention with his related activity.

Post-delivery phase is final phase of handover process. In this phase scrum master and product owner are responsible for performing activity of product vision final planning. Product owner also take part in training activities with scrum master and team. Other handover related activities of post-delivery phase as documentation, version and configuration management.
and maintainability management are the responsibility of scrum master and team. Software artifacts of post-delivery phase are mention with his related activity.

4. Proposed Model Comparison

After proposing handover Model for mockup DD, the proposed model is compared with the existing models. A comparison with existing models given in table 1.

Table 1. Comparison with existing models

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Proposed Model</th>
<th>Existing Models</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Handover for Mockup DD</td>
<td>Handover for Scrum</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OOHDM</td>
</tr>
<tr>
<td>Model to Model Transformation</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Model to Code Generation</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Constant User Feedback</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tool Support to Generate Models</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Tool Support to Transfer Models</td>
<td>✓</td>
<td>X</td>
</tr>
<tr>
<td>Agility</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Handover Activities</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Handover Lifecycle</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Handover Activities Division</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

✓ = "Fully Supported"       X = "Not Supported"
P = "Partially Supported"

The comparison is done with on scrum handover model and five model driven web engineering models. The results show that scrum model is specific model for scrum based development it does not support model driven core activities. On the other hand the model driven development models does not support the agile development processes which is now consider as the industry standard for web based development. These model driven model also does not fully support the handover process activities. The proposed model for mockup DD covers both of these aspects. The proposed handover model for mockup DD have follow the scrum practices as well as complete handover process. This proposed handover model supports industry for successful transition of software system.

5. Conclusion and future work

The mockup driven development methodology helps in the reduction of web development lifecycle process. It integrates agile practices with model driven development workflow. Mockup DD is consider to be more efficient from the other traditional MDWE in term of efforts and errors. On the other hand the handover process is a new research area. Till that time a small amount of research is
done in this research. We could not found any handover process model which support the handover practices for Model driven web engineering methodologies like mockup DD. The main contribution of this research paper is a basis handover process framework for mockup DD methodology of MDWE. This framework will facilitates the software industry to perform smooth and successful software transition process. This framework facilitates the industry in planning and executing the handover process from the beginning of the project to its ending.

As a future work related to this handover framework for mockup driven development methodology, we will evaluate this framework from industry. For this purpose we apply this framework in industry and perform industrial experimentation to check the applicability of our proposed framework. On the basis of industry results we incorporates required needs and increased the applicability of our proposed framework.

6. References