Stepwise Approach for Deploying and Automating the Organizational Capability Maturity Model (OCMM)

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Abstract: The Capability Maturity Model (CMM) is complex and difficult for organizations to utilize. In this paper, we present our proposed approach for automating CMM using Unified Modeling Language (UML) models, called Organizational Capability Maturity Model (OCMM). We discuss the implementation of our proposed system, the experiments conducted, and the results obtained. Screenshots of the system in operation, Entity Relationship Diagrams (ERDs), and system interface diagrams are presented. Manual tests and test cases conducted on the proposed model validate and verify its efficacy.

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1. Introduction

In many Software Development Houses (SDHs),project deployments suffer from overheads that cause the planned schedules and budgets to be exceeded. Some solutions from the Software Engineering Center (SECC) have been proposed; however, they do not provide any evaluation or search level service for SDHs. Consequently, we previously proposed the Organizational Capability Maturity Model (OCMM)to solve the overhead problems primarily through its ability to conduct evaluations without outside intervention.

The major problems being faced by customers are the following:

- Difficulty determining the best SDH.
- Time wasted determining the appropriate SDH.
- SDHs not following the correct path because they are focusing only on the solution, at the expense of quality.

Both organizations and SDHs are affected by the above problems, which also result in time and effort being wasted during assessments and the need to hire many employees because of the manual tasks involved.

Measurement of the capability and assessment of processes in organizations such as software houses are difficult and time consuming activities. Many organizations use different assessment techniques to assess their performance. Even though these activities have an important role in improving the capabilities within organizations, many organizations, such as software houses, find it difficult to maintain them.

We previously proposed a simple and automated system for organizations such as software houses to increase their maturity levels and maintain their standards. In this paper, we discuss the implementation of our proposed system, the experiments conducted, and the results obtained.

More specifically, a deployment diagram for the implemented system with related screenshots of the actual manual system test conducted and the results obtained are presented. For reference, the data model is also presented along with our design method and the complete relationship between the various entities.

The remainder of this paper is organized as follows. Related work is presented in Section 2. In Section 3, deployment of CMM and the proposed approach in actual organizations is discussed. In Section 4, the proposed OCMM approach is presented in detail. Finally, conclusions are given in Section 5.

2. Related Work

An analysis of the logistics capability of third party logistics organizations was conducted by Qiao and Zhao, who reported that logistics service capabilities are becoming an interesting topic in academic research and business applications. They proposed the Third Party Logistics Service Capability Maturity Model (3PL-SCMM), which is based on CMM, and divided it into five maturity levels: Basic Logistics Service Capability, Additional Logistics Service Capability, Flexible Logistics Service Capability, and value-added Logistics Service Capability. With the help of these levels they determined the limitations of logistics service capability. The model helps organizers to improve their logistics services as it gives them a view of the strong and weak parts of their services (Hongbo and Qilan 2008).

Diaz-Ley et al. (2010) proposed the Presented Measurement Capability Maturity Model (PMCMM), which aids in the definition of measurement programs and the detection of measurement improvement suggestions. It also helps to improve software measurement maturity. In PMCMM, measurement goals and implementations that are suitable for measurement maturity can be set and also used to protect companies from taking wrong decisions in terms of measurements (Díaz-Ley, García et al. 2010).

A valuable and informative report on the software industry in Pakistan was presented by Noor et al. (2007).The report includes statistics on the current number of Software Capability Maturity Models (SW-CMMs) as well as Capability Maturity Model Integration (CMMI). Further, it divides IT firms into four categories: Domestic Focused Local firms, Export-Focused Local Firms, Export-Focused foreign Firms, and Unregistered Individual groups, with statistics presented based on the first three categories. Many reasons are also presented for non-adaptation and failure of industry, including lack of locally trained CMMI manpower, no proper documentation, and the relationship between academia and industry. The only solution is to make policies and mutual agreement between all the stakeholders in the IT industry (Noor, Ahmad et al. 2007).

Staples et al. (2007) investigated the reasons for non-adoption of CMMI by organizations in which they collected information from companies selling CMMI services. They report that the reasons behind non-adaptation of CMMI include cost, small organizations, lack of time, and other Software Process Improvement (SPI) systems already being used. Common reasons between small organizations were CMMI adoption infeasibility and undesirability(Staples, Niazi et al. 2007).

CMMI and Lead Appraiser (LA) are also used to evaluate the processes utilized by companies. Cheng et al. (2011) proposed a Fuzzy Quantitative Integrated Metric Model (FQIMM) that can be used to ascertain the status of companies and evaluate their quantitative approach. They also developed a CMMI Appraisal Support System (CMMI-ASS) for self-assessment by software companies aiming for success in the appraisal process (Cheng, Chang et al. 2011).

3. Deploying the Proposed Approach

In this section, we discuss the deployment of the proposed approach, with primary focus on the user interface and working scenario.

The deployment diagrams represent the hardware of the system, the software installed on the hardware, and the middleware that can be used to connect the different machines (Khan and Heegaard, 2010). In our deployment diagram, User is able to connect to web through the TCP/IP protocol, then connect to the application server through the Local Area Network (LAN), following which the application server connects with the database server. A deployment diagram of the proposed approach is shown in Figure 1.

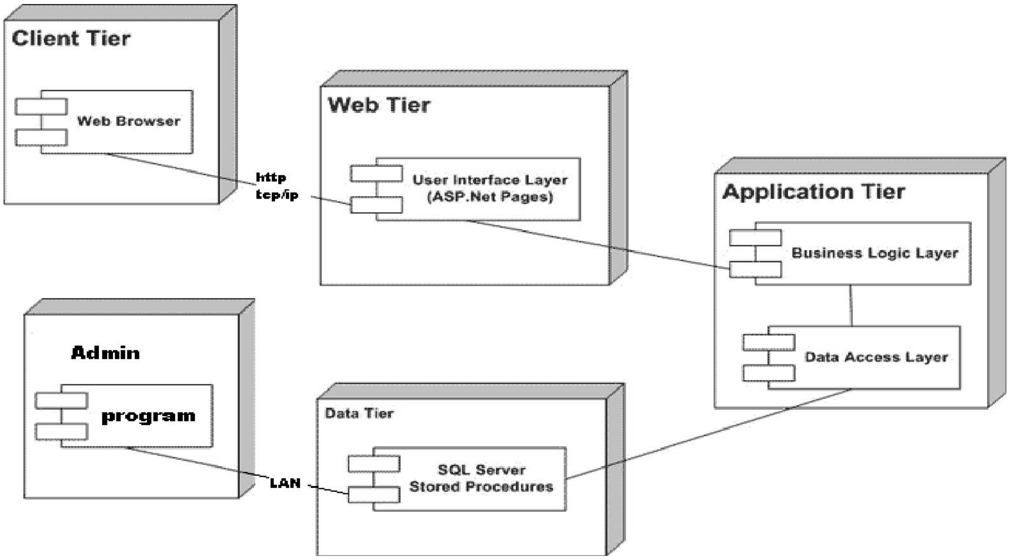
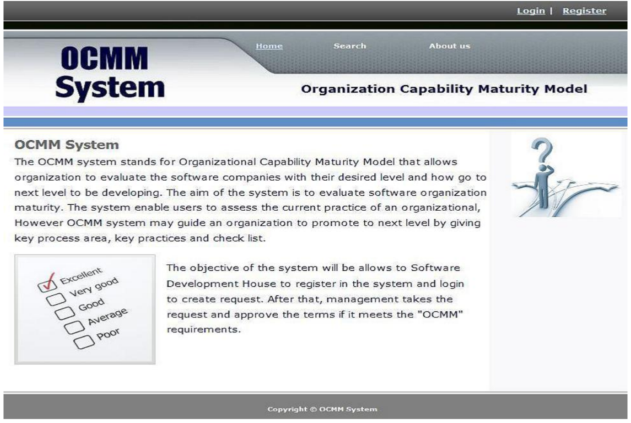


Figure 1: Deployment diagram for proposed approach

3.1 User Interface and Working Scenario (Mock-up)

A mock-up is a full sized model for a design that explains its usage for evaluation purposes. In testing the design of the system, the mock-up provides a prototype with basic functionality (Vieru, 2009). After explaining all stages of the proposed OCMM system, we show the implemented system at work and discuss its operation and main interfaces. Our OCMM system is a web based application that provides a very flexible and attractive environment to users. The homepage of the system is shown in Figure 2.



OCMM System

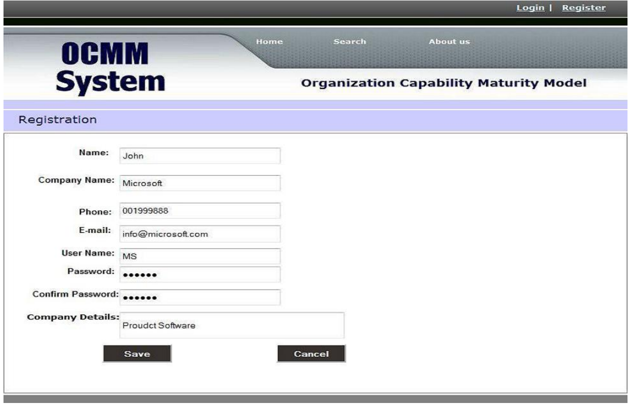
The OCMM system stands for Organizational Capability Maturity Model that allows organization to evaluate the software companies with their desired level and how go to next level to be developing. The aim of the system is to evaluate software organization maturity. The system enable users to assess the current practice of an organizational, However OCMM system may guide an organization to promote to next level by giving key process area, key practices and check list.

The objective of the system will be allows to Software Development House to register in the system and login to create request. After that, management takes the request and approve the terms if it meets the "OCMM" requirements.

Figure 2: Homepage of the OCMM system

3.2.2 Registration Page

The registration page is utilized by software houses that desire assessment through the OCMM system. Registration is carried out by completing the simple form shown in Figure 3.



Registration

Name: John
Company Name: Microsoft
Phone: 001999888
E-mail: info@microsoft.com
User Name: MS
Password: ••••••
Confirm Password: ••••••
Company Details: Proudct Software

Figure 3: Registration page of the system.

3.2.3 Page for SDHs

After registering or logging in, SDHs are able to request assessments, or if they have already made such a request, the user is able to view messages from the administrator and, after being assessed, is also able to view results, as shown in Figure 4.

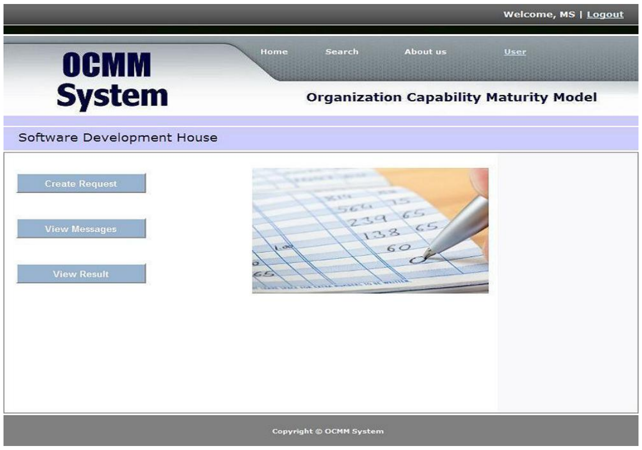


Figure 4: SDHs control page

3.2.4 Management Page

Authorization management plays a major role in the OCMM system. The user places requests to the evaluator to assess the SDHs, as shown in Figure 5.

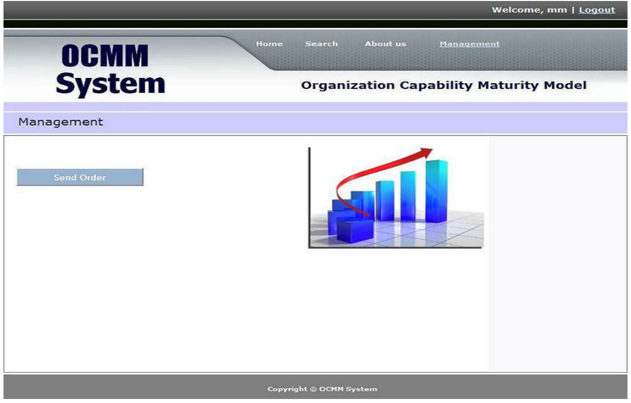


Figure 5: Management control page

3.2.5 Evaluator Page

In our proposed OCMM system, on logging in an evaluator is able to view requests for evaluation and send relevant messages, as shown in Figure 6.

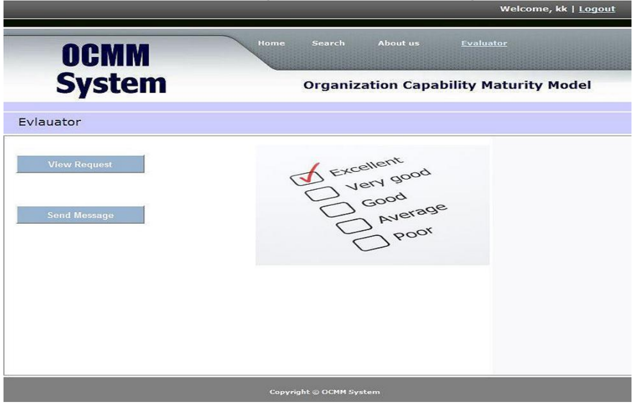


Figure 6: Evaluator control page

3.2.6 Administrator Page

In any multi-user system, the administrator is always responsible for controlling and managing each task, including security. In our proposed OCMM system, the administrator performs these core tasks and is also responsible for managing the evaluation criteria and evaluators. The administrator control page is shown in Figure 7.

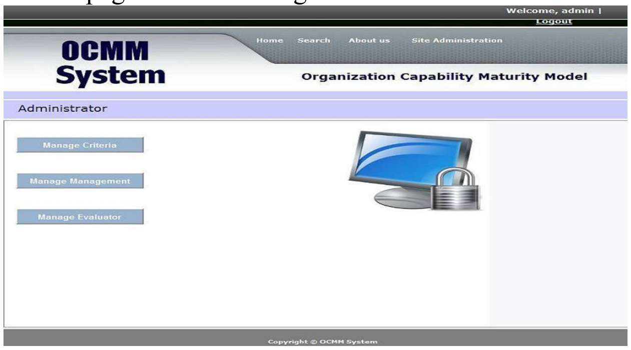


Figure 7: Administrator control page

3.3 Data Model

A data model is a tool utilized by business and IT professionals to improve communication within organizations. It comprises a set of symbols and text that is used to explain subsets of information. It also provides an accurate and flexible application environment. Even with different backgrounds and levels of experience, team members in the project can communicate with the help of data models (Hoberman, Blaha et al. 2009). The data model can also be used to define business requirements for a database, also known as database modeling, as it is implemented in a database (Whitten, Bentley et al. 2004).

3.3.1 Entity Relationship Diagram (ERD)

An ERD is a conceptual representation of data. In other words, ERD is database modeling that produces a conceptual data model of the system. ERD is used to establish structural metadata for master data entities used for sets of logical ERDs. An ERD comprises three basic elements: Entities (a thing for which information is being sought), Attributes (data, collected about entities), and Relationship (link between entities) (Yeh, Li et al. 2008). The ERD of our proposed system is shown in Figure 8.

3.4 Testing of OCMM

System testing is conducted to ensure that a complete and integrated system, which can be software or hardware, complies with specified requirements. System testing is performed over the entire system and is based on functional requirements (Hou, Shih et al. 2012).

3.4.1 Manual Testing

Finding defects manually in a newly developed system (software or hardware) is known as manual testing. In software engineering, testing whether the software is working properly or not before providing it to the end user is a key step (Kuhn, 2009). We performed manual testing of our proposed system's website. The testing technique used provides an opportunity to check every step thoroughly to ensure that each step is correctly working as per requirements. Many testing tools are also available; however, they are complex and sometimes not accurate as per requirements. Therefore, we gave preference to manual testing because it is an easy and reliable testing method. Some of the testing results obtained are shown in Table 1.

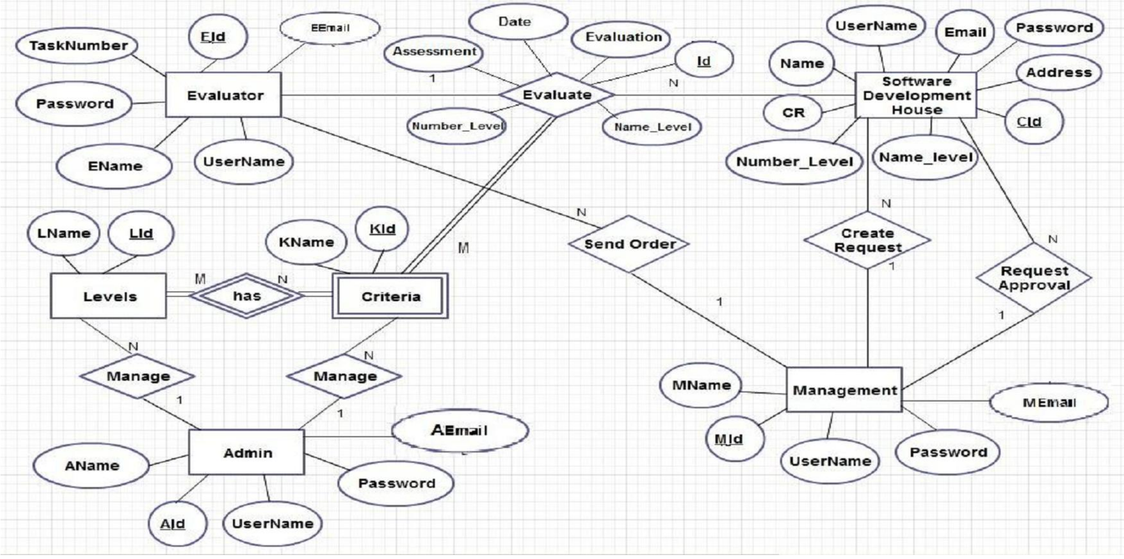


Figure 8: ERD scheme of the OCMM database

Table 1: Sample results of manual testing

Test Unit	Test Case	Result
Register	Wrong data format used in entering data into the data fields.	The system displays an error message to the user that s/he has entered invalid data in the data fields.
	Correct data entered into the data fields.	The system verifies and accepts the data entered by the user in the data fields.
Evaluation Criteria	Selecting or repeating the same criteria for the current evaluation process and entering the values.	The system displays an error message to the user that s/he has evaluated these criteria before.
	Correction of the selection and selecting new criteria and correct values.	The system verifies and accepts the criteria selected by the user into the data fields and permits the evaluation process.
Evaluator management (add, delete, and update evaluator)	Wrong data format used in entering date into the data fields.	The system displays an error message to the user that s/he has entered invalid data in the data fields.
	Correct data entered in the data fields.	The system verifies and accepts the data entered by the user in the data fields.

3.5 System Interfaces

A system interface designates various functions that are implemented as library functions (Hanzaz, 2011). Our proposed system is a web based application comprising four subsections based on user type: SDH user, management, evaluator, and administrator. General details can be accessed by any user; however, if a specific user wants to access his/her unique section, s/he can click on a link available for that purpose. After registering (if new user), or entering username and password, the user gains full access. The system interface for the proposed system is shown in Figure 9.

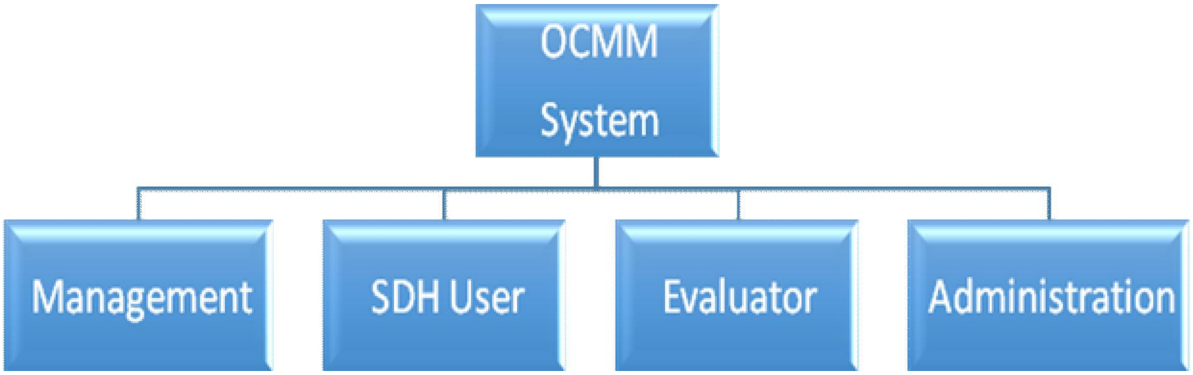


Figure 9: System interface for the proposed system.

4. Conclusion

The Capability Maturity Model (CMM) is used extensively for assessment purposes and plays an important role in improving the standard of organizations. In this study, we designed and implemented an efficient system for software houses that can be used by any organization to show testing results for various scenarios. ERD was also presented to show the details of the database system used with a complete relationship between entities.

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