Agile Development Methodology and Testing for Mobile Applications - A Survey

Ganesh Prasad P, R Hamsini, Smitha G R

Abstract— **Agile methods allow software teams to respond quickly to change. The agile approach reduces the schedule risk associated with traditional software engineering, in which integration of component parts is treated as a late-phase effort. Testing throughout the process as opposed to at the end of the project can bring a number of benefits for app developers, especially in the discovery of coding flaws or other bugs. When testing takes place on a regular basis during the development process, app developers and testing counterparts easily spot issues along the way and correct them as they go. This ensures that the project will continue smoothly and that any issues will be more easily corrected. Additionally, introducing test automation early, connecting functional along with even load and performance tests to Continuous Integration acts as a part of regression testing, where the development team takes responsibility for bugs in the code. This frees up dedicated testers and performance experts to focus on more complex use cases and determining test scenarios that cover areas outside the code, like infrastructure, corner cases and third party testing. This papers discovers different methodologies in agile that suits mobile application development along with testing.**

Index Terms— **agile; Mobile application; square methodology; application testing.**

I. INTRODUCTION

Most of the organizations often follow the agile principles of software development. Ultimately, it depends on the specific needs of the mobile app that the team is developing for each client. The agile approach to mobile app development focuses on customer involvement, adaptable planning, continuous evaluation and risks management. As a result, mobile app development projects can be completed effectively and efficiently. Regular communication with mobile app clients is must to ensure the final product is exactly what is expected and needed.

II. AGILE DEVELOPEMENT

Agile development is defined as the ability to move quickly and easily; relating to a methodology of project management which is characterized by the subtasks into brief phase of work along with adaptation of plans and frequent reevaluation.

The practices of agile development simplify mobile app development so that the resulting mobile apps are

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adaptable after release. The theory of agile development is sound, and there are several common characteristics of agile development teams that help put the theory into practice.

List of procedures for agile development is:

- Simple Design
- Ability for releases in a short period of time
- Extensive team cooperation, pair programming, and testing during development
- Anticipating the need for change
- Welcoming change and using it as an advantage

Abbreviations and Acronyms

- UI-User Interface
- XP-Extreme Programming
- HME-Hybrid Method Engineering
- MASAM-Mobile Application Software Agile Methodology
- DSDM-Dynamic Systems Development Method
- NPD-New Product Development
- ASD-Adaptive software development
- AUP-Agile Unified Process
- RUP-Rational Unified Process
- SLeSS-Scrum and Lean Six Sigma

III. MOBILE APPLICATION DEVELOPEMENT

Mobile application development is different than software development for desktop applications. The major difference between desktop development and mobile app development is the need for rapid change and constant updates. But mobile devices present an additional set of challenges based on their physical limitations.

Mobile app designers and developers are crafting software for mobile devices with small screens, limited memory, clumsy keyboards, limited battery power and less processing speed than desktop computers. Plus, the sheer number of different mobile devices, with their different operating systems and different mobile carriers, makes a universally effective mobile app even harder to come by.

Characteristics of Mobile Application Development

- Short Life Cycles
- Short Development Cycles
- Limited Hardware
- Frequently changing user demands
- Must be easily updateable
- Must download quickly

All of these characteristics add up to a big question for mobile app design and development agencies. How can mobile app development teams consistently build high-quality applications? The answer is agile development.

All of those attributes lead to a mobile app that is easy to use, adaptable, and anticipatory of changing user demands. One of the best ways to execute agile development is through collaboration between mobile app developers, designers, the client, and end users.

Agile development is especially useful for mobile app development. The agile methodology provides clients with a continuous feedback loop. Using Agile methodology mobile app design and development clients see milestones every 2-3 weeks. They aren't left to wait until the very end of the project. Agile development for mobile apps means clients provide feedback every step of the way to ensure the success of the project.

The development team needs to focus on designing the optimal UI as a starting point for mobile application development, and developers need to combine this with a workflow that represents how users actually work. Because research has shown that most complaints about mobile apps have to do with a poor user experience. So development team should ensure a good user experience by testing the app with users before release.

IV. DEVELOPMENT METHODOLOGIES

To understand on how Agile practices can be implemented in a mobile project, we surveyed research papers on mobile application development using Agile methods. As a result, we found four Agile approaches, some with the combination of non-Agile approaches: Mobile-D, HME, MASAM, and SLeSS as discussed below.

Mobile D

One of the pioneering studies in agile approach is by Abrahamsson et al. [1]. It shows that agile development provides a good fit for mobile application development environment and proposes an approach called Mobile D. It is based on XP, Crystal methodologies and Rational Unified Process (RUP) and is recommended to be used by small, co-located teams working on short development cycles. Mobile-D comprises five phases (Explore, Initialize, Productionize, Stabilize and System Test and Fix), each of which has a number of associated stages, tasks, and practices.

HME

Rahimian et al. [2] proposed a new Agile approach, the Hybrid Method Engineering (HME), created from Methodology Engineering techniques. It is based on a combination of agile methodologies, Adaptive software development (ASD) and New Product Development (NPD). It was developed in four iterations: in the first iteration, the methodology was detailed by adding practices commonly found in Agile methods; taking into account market

considerations, the second iteration included activities from NPD, a process concerned with introducing a new product or service to the market; in the third iteration, ASD ideas were integrated into the methodology, while in the final iteration prototyping was added to mitigate likely technology-related risks.

MASAM

Jeong et al. [3] proposed MASAM (Mobile Application Software Agile Methodology) that provides the process for developing the application software operated on mobile platform. It is based on XP, AUP, RUP, and the software and systems process engineering meta-model. It proposes a simple development cycle with four phases: Preparation Phase, that defines a summary and a first notion of the product, and assigns roles and responsibilities; Embodiment Phase, that focuses on understanding user's needs and defines the architecture of the software product; Product Developing Phase, that follows the principles of XP including test driven development, pair programming, refactoring and continuous integration with a close relationship with iterative testing activities; and Commercialization Phase, that concentrates on product launch and product sales.

SLeSS

Cunha et al. [4] proposed SLeSS, an integration approach of Scrum and Lean Six Sigma used in real projects of developing embedded software customizations for mobile phones. This approach enables the achievement of performance and quality targets, progressively improving the development process and the outcome of projects.

Scrum

Scrum is an agile structure that breaks app development or general software development into smaller chunks rather than a formal project plan. Each chunk is referred to as a Scrum, which is managed by an individual project manager who is generally referred to as a "Scrum Master". This technique is quite helpful in keeping the team focused on its goals.
The most frequently or commonly used agile framework as mobile development is scrum. It uses flexible strategy which is more transparent to the customers regarding the current outcomes and the progress of the project. This provides the developer to satisfy the each and every characteristics of the mobile app development.

Scrum makes progress in a series of sprints which are time boxed for a month or less than a month. At the end of the every sprint, a sprint review is conducted during which the team demonstrates the new functionality to the product owner, stakeholders and to the customer.This process is shown in figure IV.a.
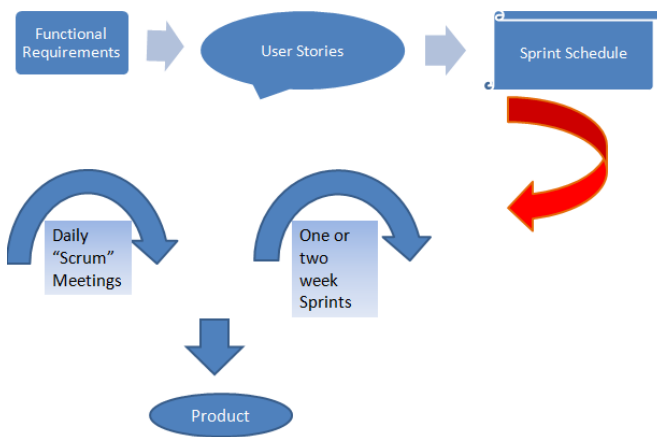
Figure IV.a: Scrum process

SQUARE D

Square methodologies falls under the dynamic system development method. Dynamic Systems Development Method (DSDM) is an agile development framework that delivers the right solution at the right time. It is build based on the Rapid Application Development. Hence it minimizes the time needed to develop the system.

The Square methodology can be integrated with the risk management framework. This methodology introduces security requirements along with the defining functional requirements. Apart from security goals the business goals are also incorporated though the development cycle. A continuous risk management policy is utilized to handle the dynamic change in the development.

V. MOBILE TESTING

Mobile apps live on several different operating systems across a wide variety of devices. As a result, a comprehensive testing process is necessary to the success of a mobile app. The key to each type of testing is a sense of collaboration and cooperation between testers and mobile design and app development teams.

Team should take an innovative approach and go above and beyond traditional techniques. This includes crowd testing. It provides real-world app success with "in-the-wild" mobile app testing. If developer wants his/her mobile app to succeed, they need users testing it as soon as possible.

The testing process is critical to agile design and development. It allows mobile app designers and developers to work closely with end users to understand how their app will be used. Additionally, the testing process also helps mobile app designers build a consistent application across all mobile devices.

Agile development integrates testing into the development process, versus having it as a separate phase. Testing therefore is an integral part of the core software development and actively participates throughout the software coding process. This allows the combined team to

better meet the project's defined business, software usability, quality, and timeline objectives.

The quintessential aspect of agile development is that development itself never ceases. A proper agile development team will continue to update and improve their application well after it has been launched. Due to the dynamic nature of mobile software, and the unique challenges presented by mobile app development, an incremental, agile approach is the best practice for mobile app producers.

Benefits offered by mobile app testing are:

1. Testing throughout the process as opposed to at the end of the project can bring a number of benefits for app developers, especially in the discovery of coding flaws or other bugs. When testing takes place on a regular basis during the development process, app developers and testing counterparts easily spot issues along the way and correct them as they go. This ensures that the project will continue smoothly and that any issues will be more easily corrected.

2. Additionally, introducing test automation early and connecting functional and even load and performance tests to Continuous Integration as part of regression testing, the development team takes responsibility for bugs in the code. This frees up dedicated testers and performance experts to focus on more complex use cases and determining test scenarios that cover areas outside the code, like infrastructure, corner cases and third party testing.

3. An agile performance testing approach also enhances transparency throughout the project, enabling developers to more easily communicate with all stakeholders as to their progress. Additionally, this technique can help ensure that the project stays on budget and will be released on time.

VI. CONCLUSION

Agile approach is one of the most popular software development approaches and methodologies. This approach needs to be modified to adapt, increase threats and vulnerabilities of an information system. Many researchers around the world are developing secure agile methodologies based on the existing agile methodologies. This paper presents a survey of different methodologies used in real time applications. Apart from that, the testing of the applications and the method used is also a challenging task for the testers to identify the vulnerabilities in the system.

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