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Challenges in Mobile Application Testing: Sri Lankan Perspective

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Abstract: Today in the software industry, software application development is a major area which is developing rapidly. Also most of the software is developing as mobile application because due to the busy life style, most of the people in the world prefer to use easy methods to do their day-today work. The application testing for mobile device is an emerging research area that most commonly faces challenges. Varieties of mobile devices need to test the application; unique features of mobile devices, limited bandwidth, and unreliability of wireless networks are most common issues faces by the mobile application testing. Also the traditional guidelines and methods used in methodologies which are used to test desktop applications may not be applicable to a mobile environment. The contribution of this research paper is to identify the issues that are faces when testing software applications for mobile devices in Sri Lankan software development industry through the interviews, questionnaire from the industry people and analysing of the gathered data. The paper includes an overview of existing problems in mobile application testing and major research questions that have been investigated. So this research paper will helpful for the upcoming mobile application developers and further researches about mobile application testing.

Keywords: Mobile application testing, Mobile devices, Mobile application, Sri Lankan software development industry, Sri Lankan Perspective

I. INTRODUCTION

Todays' world people are more familiar with technology development. Due to mobile applications are plays major role in the software industry. Companies across all industries, Mobile applications have become a "game changing" force. Over the last few years the number and variety of consumer and enterprise mobile applications has grown exponentially.

A mobile application is a computer program designed to run on smartphones, tablet computers and other mobile devices. Apps are usually available through application distribution platforms, typically operated by the owner of the mobile operating system, such as the Apple App Store, Google Play, Windows Phone Store and BlackBerry. To access business applications more and more users are moving to smartphones and tablets [1].

As a result of increasing usage of the Smart phones and Tablets, most of the software development companies starting to develop different kind of mobile applications that are fit for the current users' needs. After developing mobile applications, development team need to test the application to make sure that it mature enough to end users' requirements.

Mobile application testing is a process by which application software developed for hand held mobile devices is tested for its functionality, usability and consistency. Mobile application testing can be automated or manual type of testing [2]. Mobile devices have so many unique features. Because of that features mobile application testing process faces variety of challenges.

In this research paper, research team will analyze the challenges in mobile application testing in Sri Lanka. Following research questions will be addressed in this paper,

- What are the mobile application testing methods that Sri Lankan mobile application companies used?
- What are the challenges they faced when they doing mobile application testing?
- Identify what are the major challenges they faced when they doing mobile application testing.

The main objective of this research is to identify what are the challenges in mobile application testing in Sri Lankan perspective. Most of Western countries have done researches about challenges in mobile application testing but do not have any research about Sri Lankan perspective. Main objective of this research is identified mobile application testing challenges by doing empherical study in Sri Lanka.

This paper is organized as follows: section 2 describes Literature Review that describes background study of the research and section 3 describes how research team did this research. In section 4 discuss results that of the team gathered from this research. Section 5 includes discussion and the final section will consist of all the references that have been cited in this paper.

II. Literature Review

Although there are some research papers about challenges in Mobile Application Testing, but these studies were mainly done by Western Countries like United States, Finland, Denmark, European region and Asian Countries like India [3, 7, 9, 10, 11, 12, 14]. In this chapter describes background study of this kind of researches.

Selvam and Karthikeyani had done a research regarding Automated Test Case Design Strategies for Mobile Software Testing. In that research they clearly identified mobile application testing methods using Test Matrix (Figure 1) and key challenges in mobile application testing. Following are key challenges that they were found,

- Hardware diversity and complexity challenges.
- Software platform diversity and software complexity challenges.
- Testing web applications on Emulators [3].

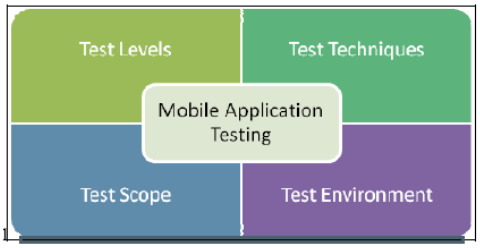

Figure I: Mobile Application Test Matrix [3]

A research which was done by Kumar and Chauhan, describes QA challengers in mobile application testing and discusses mobile testing strategies, mobile testing types and mobile testing automation tools. Under challengers in mobile application they discuss device variations, Mobile testing tool availability, Industry Standards, Cloud Computing. Research team specially describes significant challengers and risks involved in mobile application testing can impact production of mobile apps [4]. D.Knott is working as a Quality Assurance Manager at XING AG was written an article for Scandinavian Agile Conference 2012 regarding "Mobile App Testing – Challenges, Solutions and Best Practices". In that article researches described mobile application testing challenges and solutions for them with his own industrial experiences [5].

Pradhan has done a research regarding Mobile application testing which describes various elements of an effective mobile testing strategy and suggests ways to optimize testing of mobile applications. This research paper discuss testing mobile applications is more complex and time consuming compared to traditional desktop and web applications. The majority of desktop applications need to be tested on a single dominant platform – Windows. The lack of a similar dominant platform for mobile apps results in many apps being developed for and tested on Android, iOS and sometimes even more platforms [6]. Another research which was done by Aziz describes the critical areas of testing needed to certify mobile enterprise applications. That paper said UST Global's Mobile Testing Center of Excellence is a thought leader in mobile testing side and they include UST Global's best practices in that research paper [7].

Wasserman had done a research regarding Software Engineering Issues for Mobile Application Development. Those researches get details from mobile application developers in USA by using small survey. Main objective of that research was gain better idea about mobile application development practices in USA [8]. Holzer and Ondrus also had done a research regarding trends in Mobile Application Development. In their research they describe current practices by examining the development tools, different type of portals and the different level of platform integrations. Then they describe what aspects developers need to take in to account in order to position themselves within the current trends [9]. And also Eugster, Garbinato and Holzer had developed a platform "Pervaho" that can be used to developing and testing mobile ad hoc applications [10].

Most of the researches had done their research regarding usability testing of systems for mobile computers and devices. They said that area is emerging area for doing research. Beck at.al had done a research called "Experimental Evaluation of Techniques for Usability Testing of Mobile Systems in a Laboratory Setting". In their research they evaluate six techniques for usability testing in laboratory settings [11]. Kaikkonen at.al had done a research regarding usability testing of mobile applications. In their research they tested usability of mobile application in two environments. They are in a

laboratory and in a field with a total of 40 test users. In their research paper they discussed about problems that they faced in those two testing environment [12].

R.R.Nimbalkar in India had done a research similar to our research area but in Indian perspective. In this "Mobile Application Testing and Challenges "researcher clearly described mobile application testing methods and challenges in mobile application testing. In this research paper he describes Mobile App testing life cycle. These are the key mobile testing challenges researcher identified in his research [13], Multiplicity of mobile devices with different capabilities, features and restrictions, Extra hardware elements like scanners, mobile telephony, GPS and position based devices place additional demands on the tester, particularly in terms of isolating a bug to hardware or software, Multiple operating systems that are prevalent in the mobile space like Symbian, Android, iPhone OS, Windows, Linux, Blackberry OS, palm OS, Brew, etc. , Development and testing teams often miss is that mobile application development takes a lot less time duration then mobile application testing [13].

J.Dehlinger and J.Dizon in Towson University had done a research regarding "challenges and Research Direction in Mobile Application Software Engineering". This paper researches briefly described four current challenges that they see for mobile application software engineering. They are, designing universal UIs, developing for mobile application product lines, supporting context-aware applications and balancing agility with specifying requirements uncertainty [14]. M.E.Joorabchi at.al had done a research called "Real Challenges in Mobile App Development" .In that research researches found many key challenges. Such as s developing apps across multiple platforms, lack of robust monitoring, analysis, and testing tools, and emulators that are slow or miss many features of mobile devices [15].

III. METHODOLOGY

This section provides the process to achieve research questions. The main target of this research paper is to identify the challenges in mobile application testing related to Sri Lankan perspective. The research questionnaires are based on: What are the challenges in mobile application development in Sri Lankan mobile application development industry.

In order to answer this question, an online survey and interviews are used, which is very efficient way to gather information. The online survey using questionnaire was carried out among IT industrial people from various software houses and other IT related individuals in Sri Lanka during September 2014. To make the online survey Google drive was used, which was very helpful to conduct as much as professional way.

The method used to collect was by online questionnaires, which is consisting of 16 questions. The questions was mostly close-ended and few open-ended. 6 out of 16 questions were based on demographical factors. To make all those questions the research team used research papers and lecture-in-charge guidelines. The feedbacks were entered in to spreadsheet and calculations were done. All of the data were represented using pie charts, column charts and bar charts with the help of Microsoft Excel. The final results were categorized as follows.

- The percentage of respondents who works in IT industry.
- The percentage of respondents who works in mobile development industry.
- The percentages of reasons for using mobile testing.
- The percentages of different components mostly used in Mobile Application Testing.
- The percentages of different platforms used in Mobile Application Development.
- The percentages of different Mobile Testing Tools used in Mobile Application Testing.
- The percentage of respondents who think Sri Lankan mobile development companies are facing challenges in Testing.
- The percentages of different challenging element when effecting testing Applications.
- The percentages of different challenges faced in mobile application testing.
- The solutions to reduce challenges.

The assumptions research team made are sample used were clearly representing the population, the respondents having given truth information, no invisible innervation for the respondents in providing trustful facts were used to support the research in order to get more precise results.

IV. RESULT AND DISCUSSION

This section of the research paper will describe the research outcomes based on gathered information. Information was gathered using interviews and online questionnaires. A total of 52 responses were received including the interview. 1-4 questions in the questionnaire were used to get information about demographical background of the respondents. By doing this demographical study, limited this questionnaire to people who involved in IT industry in Sri Lanka.

The information the research team got from questionnaire responses were studied analyzed and represented in graphical format as follows:

A. High-maturity IT firms respondents

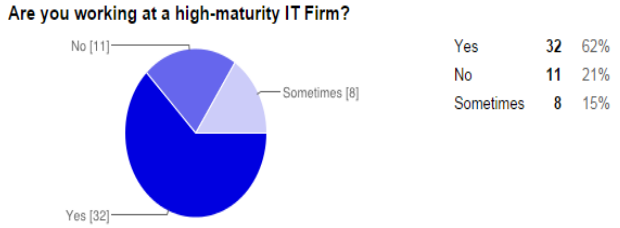

Figure II: Proportion of respondents working at Mobile Application Development process

Using above Figure II, research team gathered 62% of responses from people who are working at a high- maturity IT Firms

B. Mobile Application Development Process Practitioner Statistics

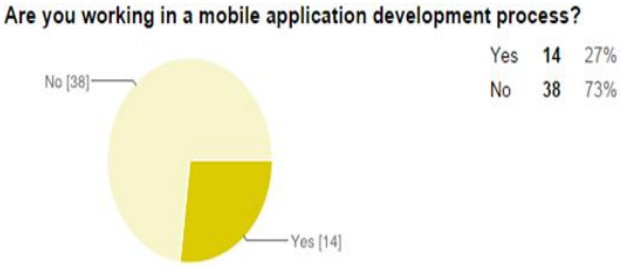

Figure III: Proportion of respondents working at Mobile Application Development process

As displayed in Figure III 27% of respondents are currently involved in mobile application development process in Sri Lanka. However 73% has responded they do not work in mobile application development process. Research team asked another question from respondents who give negative responds for above question. The question contained they like to join mobile application development process in future. 81% of respondents said they do not like mobile application development process because of challenges in development and testing in Sri Lanka. Analyzing this question researches got idea, essentiality of doing research to identify "Challenges in Mobile Application Testing: Sri Lankan Perspective".

C. Most Challenging Phase in Mobile Development Process

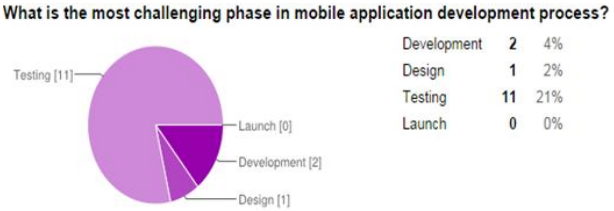

Figure IV: Proportion of most challenging phase

In Figure IV, 11 out of 14 which are 21% of the respondents said most challenging phase in mobile application development process is testing.

D. Purpose of doing Mobile Testing

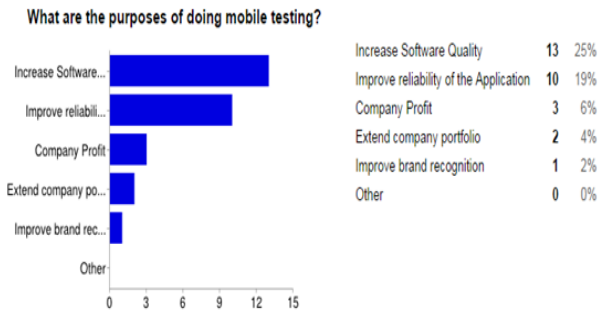

Figure V: Proportion of purpose of doing Mobile Testing

The research team asked another question from respondents about purpose of doing mobile testing. As displayed in Figure V, most of them said they doing mobile testing for increase software quality and improve reliability of application.

E. Mostly used Mobile Application Testing Components

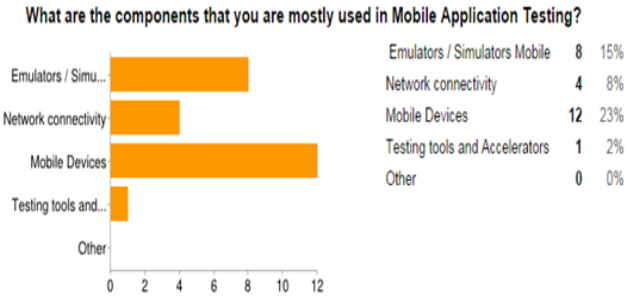

Figure VI: Proportion of most used mobile application testing components

As displayed in Figure VI, most used mobile application testing components are mobile devices, mobile Emulators and Simulators.

F. Mostly used Mobile Application Testing Tools

According to the below Figure VII, mostly used mobile application tools are Robotium, Selenium, Cucumber, MonkeyTalk, Eggplant and Android Lint.

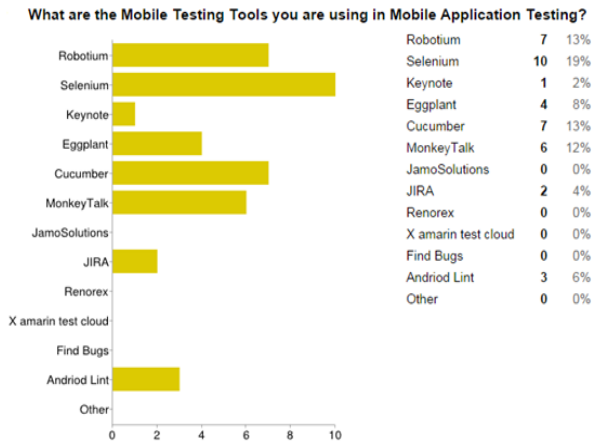

Figure VII: Proportion of mobile application testing tools

G. Most Challenging Element in Mobile Testing

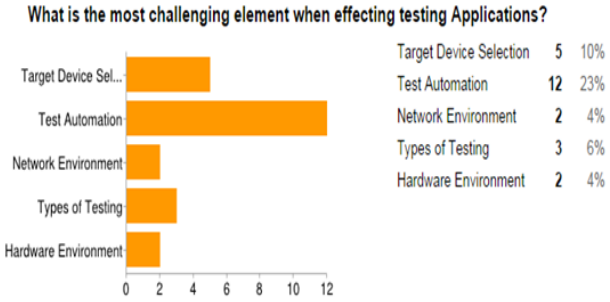

Figure VIII: Proportion of most challenging element in testing

As displayed in Figure VIII, most challenging elements of the mobile testing are Test Automation and target device selection.

H. Mostly Used Testing Types in Sri Lanka

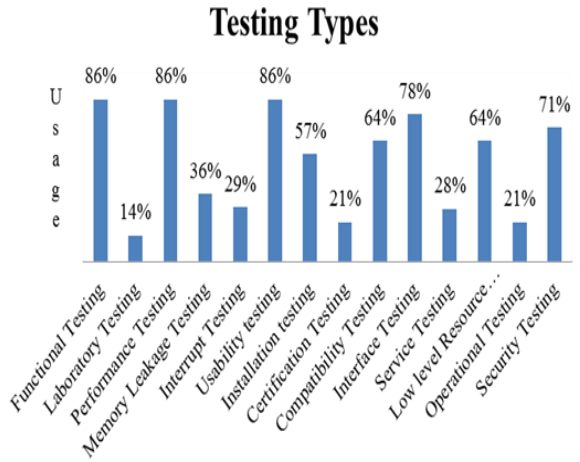

Figure IX: Proportion of mobile testing types in Sri Lanka

The research team asked question about high frequently using mobile testing types that used in Sri Lankan mobile development companies. In above Figure IX, can see proportion of most used mobile testing types. According to the above diagram in Sri Lanka most used mobile testing types are Functional Testing, Performance Testing, Usability Testing, Installation Testing, Interface Testing and Security Testing.

I. Challenges in Mobile Application Testing

The main objective of this research is to identify what are the challenges in mobile application testing in Sri Lankan perspective. In questionnaire, researches asked question named "What are the challenges that you are facing in mobile application testing". Then we categorized that question in to five sub sections. They are Target Device Selection, Network Environment, Hardware Challenges, Test Automation Challenges and QA Challenges. In below Figure X, display that challenges in detail.

Following are the key challenges that mobile testers facing in selecting target devices,

- Diversity in Mobile Platforms/OS
- Variety of Mobile Devices
- Multiple Browsers
- Mobile devices have different application Runtimes

Analysing below figure these are the key challenges in testing mobile application in Network Environment,

- Multiple types of Networks (GSM / GPRS / Wi-Fi / Wi-Max)
- Unpredictable time taken for data transfer
- Different speed of connectivity across geographies
- Multiple Network Operators with customized Network features

After analysing below Figure X, following are the challenges that Sri Lankan testes facing in Test Automation,

- Testing the complete application
- Relationship with developers
- Regression testing
- Lack of skilled testers
- Testing always under time constraint
- Which tests to execute first?

Following are the key hardware challenges that Sri Lankan mobile developers are facing in testing applications,

- Limitations in processing speed
- Limitations of Memory size of mobile
- Differences in Communication Protocols of devices WAP/ HTTP

Finally analyzing details researches could found Quality Assurance challenges in Sri Lankan mobile Testing. They are,

- Scripting
- Cloud Computing
- Mobile Testing Tool Availability
- Industry Standards
- Need for skills QA specialist in Automation Testing
- High testing time consumption

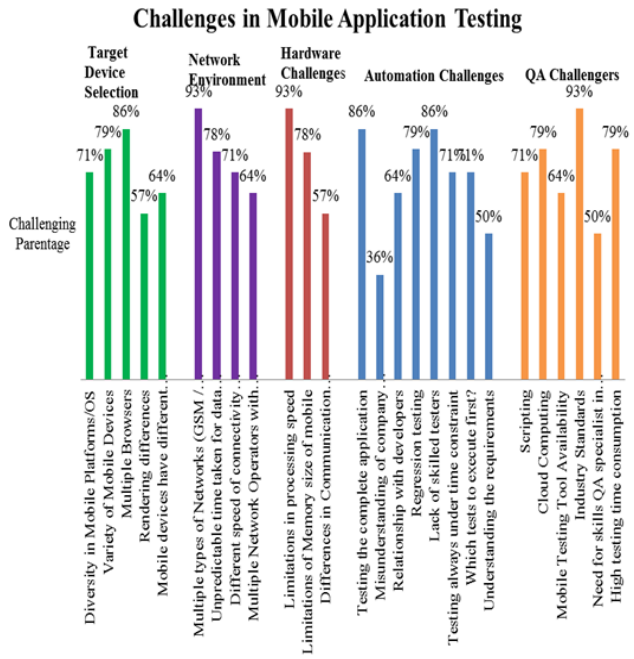

Figure X: Proportion of Challenges in mobile application testing in Sri Lanka

Last question in questioner the team asked from respondents if they have any idea about solutions of above challenges. Some of them give us to good solutions. Those are,

- Well defined requirement and test cases before development process would make sure the developers that they don't fail the test cases.
- Used large QA team and testing in different way
- Assign testing people with Quality Assurance (QA) and Software Development Knowledge, then it's easy to handle testing process
- Assign well experience QA people to process

V. CONCLUSION

In this paper aim to provide understanding about the Challenges in Mobile Application Testing in Sri Lanka. The main goal of this study is focused on appearance of Mobile Application Testing, insight from Software Practitioners in Sri Lanka. The main objective of this study was to investigate about the challenges in Mobile Application Testing in Sri Lanka. The results were gathered by a survey from 52 respondents who work in different IT organizations in Sri Lanka. Therefore the research team found that as a limitation for this research it also affects the accurate results and for a good research project.

As the responses Diversity in Mobile Platforms/OS, Variety of Mobile Devices, Multiple Browsers, and Mobile devices have different application runtimes are the key challenges that mobile testers facing in selecting target devices. The challenges that Sri Lankan testers facing in Test Automation are testing the complete application, Relationship with developers, Regression testing, Lack of skilled testers, testing always under time constraint, which tests to execute first. The key hardware challenges that Sri Lankan mobile developers are facing in testing applications are Limitations in processing speed, Limitations of Memory size of mobile, Differences in Communication Protocols of devices WAP/ HTTP.As the Quality Assurance challenges in Sri Lankan mobile Testing the research team identified Scripting, Cloud Computing, Mobile Testing Tool Availability, Industry Standards, Need for skills QA specialist in Automation Testing, High testing time consumption.

For the future works the research team will also use interviews to strengthen the results the team has found from the survey. Also the research can expand in to more advance by researching Challenges in Mobile Application Testing in the World. This study adds evidence to the knowledge of Mobile Application; at the same time it provides knowledge and reference about Challenges in Mobile Application Testing.

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REFERENCES

[1] " Load Testing Mobile Application", NEOTYS, [online]. Available: http://www.neotys.com/introduction/mobile-load-testing.html.[Accessed: July.2, 2014].

[2] Wikipedia," Mobile application testing", Wikipedia, Aug. 07, 2014 [online]. Available: http://en.wikipedia.org/wiki/Mobile_application_testing. [Accessed: Aug 12, 2014].

[3] R.Selvam and V.Karthikeyani. " Mobile Software Testing Automated Test Case Design Strategies", International Journal on Computer Science and Engineering (IJCSE), vol.3, No.4, April 2011.

[4] M.Kumar and M.Chauhan,"Best practices in Mobile Application Testing",Infosys Limited ,India,

2013,[online].Available:http://www.infosys.com/flypp/resources/Documents/mobile-application-testing.pdf [Accessed: Aug.2, 2014].

[5] D.Knott, "Mobile App Testing Challenges, Solutions and Best Practices", March 2012 [online].Available: http://dnlkntt.files.wordpress.com/2012/03/mobile_app_testing_daniel_knott.pdf. [Accessed: Aug.14, 2014].

[6] T.Pradhan," Mobile Application Testing", TCS White papers, [online].Available: http://www.tcs.com/SiteCollectionDocuments/White%20Papers/Mobility_Whitepaper_Mobile-Application-Testing_1012-1.pdf . [Accessed: Aug.4, 2014].

[7] S.Aziz ," Mobile Application Testing", UST Global Inc,Canada,2012, [online].Available: http://www.ust-global.com/en/images/stories/pdf/Mobile_Testing.pdf. [Accessed: Aug.4, 2014].

[8] A.I.Wasserman,"Software Engineering Issues for Mobile Application Development", [online].Available: https://www.cmu.edu/silicon-valley/wmse/wasserman-foser2010.pdf. [Accessed: Aug.5, 2014].

[9] A.Holzer and J.Ondru ," Trends in Mobile Application Development", [online].Available: https://www.cmu.edu/silicon-valley/wmse/wasserman-foser2010.pdf. [Accessed: Aug.7, 2014].

[10] P.Eugster,B.Garbinato and A.Holzer," Pervaho: A Development & Test Platform for Mobile Ad hoc Applications", [online].Available: https://docs.di.fc.ul.pt/jspui/bitstream/10455/3007/1/06-10.pdf#page=23 [Accessed: Aug.8, 2014].

[11] E.T.Beck,M.K..Christiansen, J.Kjeldskov, N.Kolbe and J.Stage ," Experimental Evaluation of Techniques for Usability Testing of Mobile Systems in a Laboratory Setting", [online].Available: http://people.cs.aau.dk/~jesper/pdf/conferences/Kjeldskov-C17.pdf [Accessed: July.7, 2014].

[12] A.Kaikkonen, A.Kekäläinen, M.Cankar, T.Kallio and A.Kankainen, " Usability Testing of Mobile Applications: A Comparison between Laboratory and Field Testing", Journal Of Usability Studies, vol.1, pp.4-16, November 2005.

[13] R.R.Nimbalkar," Mobile Application Testing and Challenges", International Journal of Science and Research (IJSR), India, vol.2, July 2013.

[14] Dehlinger and J. Dixon, "Mobile Application Software Engineering: Challenges and Research Directions", [online].Available: http://www.mobileseworkshop.org/papers/7_Dehlinger_Dixon.pdf. [Accessed: Aug.11, 2014].

[15] M.E. Joorabchi ,A.Mesbah and P.Kruchten, "Real Challenges in Mobile App Development", [online].Available: http://www.ece.ubc.ca/~amesbah/docs/mona-esem13.pdf. [Accessed: Aug.15, 2014].