Challenges in Mobile Application Testing: Sri Lankan Perspective

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Abstract—In Sri Lanka mobile technologies have important influence on processes in ICT with software development companies. Mobile technologies have a new type of software has emerged called mobile applications. Nowadays, the main concepts of mobile applications are broadly known and the development of mobile applications is more and more extensive. One of the most significant parts of mobile application development is mobile applications testing. The testing procedure has always been very vital and crucial in the software development life cycle. Testing establishes an important aspect of software development to get a good output. A suitable testing procedure knowingly increases the quality level of the industrialized product with mobile application development testing, new challenges linked with mobile technologies and device features have arisen. Some instances of these tests are connectivity, suitability, touch screen technology, context consciousness, supported devices, etc. It is significant that sufficiently address these challenges and perform a suitable mobile application testing process, resulting in a high quality application without critical defects that could cause quality issues or the annoying waste of human or financial incomes. In this paper will present a mobile application testing procedure. Mentioned the important parts and particularly emphasize the challenges related to mobile devices and technology structures and assets.

Keywords—Mobile applications testing; test cases; mobile security; mobile technology; quality; test challenges

I. INTRODUCTION

Nowadays in Sri Lanka Mobile devices and mobile applications play a significant role in everyday lives. Everyone enclosed by mobile technology and cannot visualize running personal or business shops without mobile or hand handle devices. Increasing of applications development is Sri Lanka is very high compare with last year application stores. There are lots of outsourcing projects to Sri Lanka as well. Every business person looks into develop mobile applications to market their products. In Sri Lanka most of people using Android OS support devices and there is iOS and Windows mobile devices as well. Therefore, it is big challenge for the software developing company to develop and test the application to compatible for each devices.

The operating system is not only the problem, in Sri Lanka software developing companies should have to buy the hardware devices to test with the compatible, it is expensive and testing an application is also time consuming. Applications are running on mobile devices mobile applications running on smartphone or new generation tablets are becoming so popular that they are on behalf of a revolution in the IT sector.

Mobile application development has detailed characteristics that need to be spoke through the entire product’s life cycle. According to a recent study, there are significant software engineering research issues allied to mobile application development. Some of these issues include possible communication with other applications, treatment available sensors, the development of natural mobile applications, different operating systems of hardware and software mobile stands, glitches of security, an adjusted user interface and the problem of power feeding.

Testing procedure plays a significant role in the life cycle of a software creation, whether in mobile or old-style desktop application. Therefore, it is vital to address above stated issues in connected mobile testing procedures. Here is research questions and answers:

- Why application testing is very important?
- Why customer needs bugs free application?
- How to test mobile applications?
- Why Sri Lanka is important for application development?

Once developed the application, testing part is very important to produce error free software product to the customer and also to makes sure that the application is correctly developed according to the client requirements. To make good relationship with the customer, bugs free application is required. To free the bugs, software

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development companies required test passed applications. There are several test cases available and open source or purchase tools available to test. Refer literature review section for more details. Due to fast growing economy with high quality software development companies, Sri Lanka have great potential in the mobile application development industry.

In this paper will present a testing process for testing mobile applications for Sri Lankan software development companies. Mentioned and described exact characteristics for mobile hardware devices, applications and technologies as entire, which have a significant impact on the testing procedure. Everything will be covered with a practical method for mobile application testing procedures and added experiences. In the Discussion, at the end presents the findings and results of this work.

II. LITERATURE REVIEW

Testing of mobile applications development for mobile or hand handle devices is an emergent research area that looks a variety of tests due to unique and time to time change features of mobile devices, restricted bandwidth, undependability of wireless networks, as well as varying environmental factors. Out-of-date guidelines and methods used in testing of desktop applications may not be directly appropriate to a mobile environment. Therefore, it is important to develop and accept appropriate research procedures that can assess the usability of mobile applications [1].

Mobile application programming languages enhance some specific constructs for handling mobility, sensing, and energy feeding. The individualities of those original programming languages have to be taken into explanation when producing control or data flow charts and their particular coverage criteria of the mobile programming language. New treatment criteria shall be though as a way to consider at best the new mobility, sensing, and energy constructs. In circumstance the source code is not obtainable, new byte code analysis tools can be realized [2].

The exponential development of this mobile market and the criticality of the testing applications impose an increased care to dependability aspects of applications running on specific type of mobile devices. As confirmed in some studies, a mobile application is vaguely clear as an application running on mobile devices or hand handle devices. GUI testing is a first priority testing essential in mobile applications. Dissimilar mobile devices can respond otherwise to the same application code and this needs to be tested, as claimed in. The authors propose a method for detecting GUI bugs by mechanically generating test cases, nourishing the application with random proceedings, instrumenting the VM, and creating log or trace files and examining them post run. The Android Monkey tool[13] delivers structures for stress testing of mobile applications GUI testing [3].

Android Robotium is an easy and open source tool that allows developers to automate and black box test execution of third parties applications. The Monkey Runner tool can provide an automatic functional test for Android mobile applications. Mobile Test accepts a sensitive event based method for the automatic black box testing of software running on mobile devices or hand handle devices [4].

Statistical fault localization for mobile embedded system, contexts that have a higher chance to make faults are selected. Overall reporting criteria for context conscious inputs seem to be still missing. Automatic analysis of errors or failures detected during application testing can greatly improve the effectiveness of the debugging process, and help to make applications additional reliable. In this research paper, propose an approach, dubbed MZoltar, contribution dynamic analysis of mobile application that products a diagnostic report to assistance classifying potential defects rapidly. The method also offers a graphical picture of the analytic report which make it easier to understand. The experimental results show that the method needs low runtime overhead (5.75% on average), though the tester needs to inspect five components on regular to find the faults in a mobile application [5].

Mobile applications are not bug free and new software engineering methods are required to test applications. Current bugs are due to interoperability difficulties that exist today among the application, operating system like Android/iOS/Windows, framework, and hardware device [6].

Propose a practice to choice user level test cases for execution energy cost evaluation of smartphone applications. Enhancing the energy efficiency of mobile applications can importantly increase user satisfaction. However, developers lack feasible methods for approximating the energy feeding of mobile applications. This paper proposes a new method that is both lightweight in terms of its developer requirements and delivers fine grained approximations of energy consumption at the code level [7].

New testing criteria are compulsory to provide the guidelines, rules, and plans by which mobile test cases are selected so to exploit coverage in case of random and variable contextual inputs. Models of contextual scenarios may be used to energy the systematic selection and coverage of Mobile Applications. For example, if a tracking application creation use of GPS informations wants to be tested, the test suite could previously include parametric inputs related to the GPS input scenario. Changed contexts are created and used for testing drives, but without a coverage standards [8].

Categorizes contextual evidence into human factors example: user, social atmosphere, and task and physical environments example: location, structure, and physical conditions [9].
Since mobile application testing towards different networks represent a individuality of mobile applications, old-style security testing methods shall be revised to keep in deliberation contextual factors, that shall be simulated so to check which data is communicated from the mobile device. The authors analyze the pressures Android applications pose to the security and privacy of innovativeness and propose several approaches for defensive enterprises against security risks [10].

A lot of investigation has dealt with the basics of software testing, therefore there are many accessible definitions of testing. To recap one of the definitions: testing is an activity did for the purpose of evaluating creation quality, and for improving the creation by identifying possible defects and problems. Software testing is composed of the active verification of the program behaviour on a limited set of test cases in contradiction of the expected program behaviour [11].

The challenges met during mobile application testing were mostly related to the different features of mobile devices or mobile technologies, which has a straight effect on mobile applications and the lead testing procedure. In the existing literature, found many dissimilar described features [12].

Mobile devices and mobile applications production plays significant role in everyday lives. Today everyone surrounded by mobile technology and cannot visualize running individual or business shops without them. This has been confirmed by many bits of research. According to Gartner, the universal sale of mobile phones in the third quarter of 2012 touched almost 428 million components. Within this number, smartphone sales signify almost 40 percent of total mobile phone sales. A comparable thing is happening in the area of mobile contributions. At the end of 2012, there were about 6.8 billion mobile subscribers in the universe, which is equal to 96 percent of the world population. Now, global mobile-cellular diffusion rates are 96 percent. In Europe the number is developed, at 126 percent [13].

The characteristic that is more complicated in the developing process, but silent part of the testing process, is related to fresh programming languages that are used for mobile application development. These programming languages were established to support mobility, handling resource feasting and handling new GUIs. It is significant that code during the development process is tested correctly, according to the structures and characteristics of programming languages [14].

Carefully connected to mobile devices are mobile applications by the end of 2012, there were around 1.1 million mobile applications users. According to predictions, the number will grow rapidly – by nearly 30 percent per year. To reach 4.4 billion by the end of 2017. Applications created $12 billion in revenue in 2012 and entire of 46 billion applications were downloaded. This number is also predictable to grow in 2013 smartphone and tablet users will download a further 82 billion applications. Mobile applications are currently signified in almost every possible personal or business field [15].

According to Figure 1 which is done by Net Market Share, most of the users willing to use Android and iOS support mobile phones. Still there is no good response for the Windows mobile phones.

### III. METHODOLOGY

The research was defined as descriptive for it describes features of challenges in mobile application testing for Sri Lankan perspective as well as it establishes relationships between variables through a standardized data collection technique. It is an approach is quantitative, once the research used quantification not only in the data collection process, but also in their treatment through statistical methods.

The data collecting tool was a questionnaire with 10 questions was carried out among various IT individuals and software companies.

Mobile Technology is changing the way people use their smartphones. Though demand is top for consumer apps, enterprise mobile applications are evolving too, letting businesses to work more efficiently. Right from Publishers, Vendors, Car Dealers, Commercial Service Providers, Pharmaceuticals & Healthcare Sectors Providers, mobile application habit trend has now extended to schools and Campuses providing faster communication between staff and students. Due to the growing demand for mobile application, decision architects are focusing on creating mobile plans and roadmap before applying the application for their users. It is vital to build an application with all features and functionality required by the client and which is helpful to the application user, but it is even more dangerous to have a difficult mobile testing plan before the mobile application is deployed. A complete plan gives clients the sureness that the application will function as planned on different devices with variable screen sizes, operating systems, resolutions, hardware, and across mobile service providers from all kind of networks.
A good end to end mobile application testing process should start from making test cases of the application, execution user acceptance and finally device testing phase. The phases in mobile application testing procedure are as follows:

- Test case preparation.
- Automated script identification and modification
- Manual and automated testing.
- Usability testing.
- Performance testing.
- Security and compliance testing.
- Device testing.

IV. RESULTS AND DISCUSSION

This section will provide statistical analysis of each questions that were published in the questionnaire for industrial personals. There are very good responses gathered and analysed, following are the analysis results of each questions:

1. How are you testing the mobile applications?

   - Automatically [5] 38%
   - Manually [6] 46%
   - Hybrid (both) [2] 15%
   - Other [0] 0%

2. Have you developed the same mobile application across different platforms?

   - Yes, port [2] 31%
   - No, port [4] 31%
   - Yes, from scratch [4] 31%
   - Yes, port part of it [2] 15%
   - Yes, other [5] 23%

3. Who is responsible for testing the mobile application?

   - Developer [8] 62%
   - Testing team (local) [7] 54%
   - Beta tester [5] 36%
   - No testing [1] 8%
   - Other [0] 0%

4. What levels of testing do you apply?

   - Unit Testing 5 38%
   - Integration Testing 5 38%
   - System Testing 7 54%
   - Regression Testing 8 62%
   - GUI Testing 4 31%
   - Acceptance Testing 7 54%
   - Performance Testing 9 69%
   - Usability Testing 4 31%
   - Security Testing 8 62%

5. Where do you run your mobile tests?

   - Emulator [5] 30%
   - Devices [2] 15%
   - Both [6] 46%
   - None of the above [0] 0%

6. What are the key challenges of mobile application testing?

   - Variety of Mobile Devices [12] 92%
   - Diversity in Mobile Platforms [13] 100%
   - Mobile network operators [5] 36%
   - Scripting [4] 31%

7. What types of mobile applications do you have tested?

   - Android [12] 92%
   - iOS [7] 54%
   - Windows [2] 15%
   - BlackBerry [0] 0%
   - Other [0] 0%

8. Are you using open source tools for the testing?

   - Yes [12] 92%
   - No [1] 8%
According to the above analysis, 93% IT industrials thinking that mobile application testing is very important for the customers. In Sri Lanka, 92% developers developing android mobile application, iOS 54%. Considering the level of testing, most of QA engineers or developers using performance testing and security testing. Specially there are few companies developing and testing same application for different operating systems and devices. 92% testers using open source tools for the testing.

The main challenges in mobile application testing from this analysis are variety of mobile devices and different operating systems. In some of the company developers testing the applications, this is not good sign to get good output, testing should be done with different persons like QA engineers.

V. CONCLUSION

Those companies in Sri Lanka who carelessness testing in their mobile application development lifecycle, do so at their own risk. There was a period when the testing environment was indeed too difficult, too heavy to be completed using standard means. But appreciations to the rapid evolution all that has now changed.

Every developer can design and develops improved quality of mobile applications by testing each feature of mobile application such as functionality, usability and reliability. These tendencies shows, that developer can never use the same testing methodologies as some of the developers have been using on the straight web and desktop applications, we have to plan a new strategy and methodology, which is going to take into explanation what really is the mobile world, what it creates of and the changes it calls for in our predictable testing patterns and strategies. In this research paper explained, all the main challenges in mobile application testing Sri Lankan perspective.

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