Рабочая программа дисциплины
Аналитика мобильных приложений
(на английском языке)
Mobile Application Analytics

для образовательной программы «Системная и программная инженерия»
направления подготовки 09.04.04 «Программная инженерия»
уровень - магистр

Разработчик программы
Макаров С.Л., к.т.н., доцент, smakarov@hse.ru

Одобрена на заседании департамента программной инженерии «___»______________ 2016 г.
Руководитель департамента Авдошин С.М. ____________________

Утверждена Академическим советом образовательной программы
«___»______________ 2016 г., № протокола__________________

Академический руководитель образовательной программы
Александров Д.В. ____________________

Москва, 2016

Настоящая программа не может быть использована другими подразделениями университета и другими вузами без разрешения подразделения-разработчика программы
1 Course Description

a. Title of the Course

The course title is Mobile Application Analytics.

b. Pre-requisites

Studying of the "Mobile Application Analytics" discipline is based on the following courses:
- Programming,
- Introduction to Software Engineering,
- Functional and Logic Programming,
- Data Bases,
- Program Verification,
- Quality Provision and Testing,
- Operating systems,
- Software Constructing,
- Algorithms and Data Structures,
- Foreign language (English).

c. Course Type

The course is elective.

d. Abstract

The course introduces techniques, technologies and software used to build and analyze mobile applications. Topics include basics of mobile application analytics, debugging, logging and testing applications and more. There are 7 laboratory exercises with the same assignments for each student.

2 Learning Objectives

The discipline goal is to give students basic skills of mobile application building and analyzing using different techniques which eventually help students evaluate and analyze their mobile application.

Topics to be learnt and tasks to be solved to achieve the goal are:
- getting to know different types of mobile operating systems;
- differentiating between different types of environments used to develop mobile applications;
- meeting the special features of mobile application analytics;
- studying extra techniques and ways of mobile application programming;
- getting skills in developing, analyzing and testing of mobile OS application (Android by default) by solving different tasks during the course studies.

3 Learning Outcomes

As a result of studying the course a student is supposed:

- to know and be able to use:
  - basic concepts, approaches and techniques of mobile application analytics;
  - different software for doing that;
special features of mobile application analytics;

_to be able to:_

- develop, test and analyze a mobile OS application (Android by default);
- search, install and use at least one of the environments for mobile application development;
- make changes of a mobile application programming code and understand ideas and code of the third party applications.

As a result of studying the course student develops the competencies shown in table 4.1.

### Table 4.1 - Student competence description

<table>
<thead>
<tr>
<th>Competence</th>
<th>Key</th>
<th>Descriptors</th>
<th>Forms and techniques of the study which lead to developing the competence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being able to create principally new ideas and products, being creative, initiative.</td>
<td>SPC*-M8 (PC-8)</td>
<td>Student shows ability to create an idea and put it into a new mobile application which is then developed using skills taken during the laboratory assignments.</td>
<td>Attending lectures, preparing and solving different homework tasks, attending laboratory works, searching and studying information needed using internet resources.</td>
</tr>
<tr>
<td>Being able to work in a multidisciplinary team including international environment.</td>
<td>SPC*-M9 (PC-9)</td>
<td>Student shows ability to communicate in an international environment and to explain his ideas to other team members, to share work needed to be done between colleagues and to be responsible for his/her particular part of the work.</td>
<td>Attending lectures, preparing and solving different homework tasks, attending laboratory works and working as a group, working on the project in a team, searching and studying information needed using internet resources.</td>
</tr>
<tr>
<td>Ability to plan, manage and control meeting requirements.</td>
<td>PC-13</td>
<td>Student is able to develop a requirement set for the mobile application being developed and fulfill them.</td>
<td>Attending lectures, preparing and solving different homework tasks, attending laboratory works, searching and studying of information needed using internet resources.</td>
</tr>
<tr>
<td>Ability to apply up-to-date software development technologies using automated systems of planning and management, ability to fulfill quality control of the software being developed.</td>
<td>PC-18</td>
<td>Student is able to control and follow the software development plan and can evaluate a quality of the developed software at any time so as to make changes if necessary.</td>
<td>Attending lectures, preparing and solving different homework tasks, attending laboratory works, searching and studying of information needed using internet resources.</td>
</tr>
</tbody>
</table>

* SPC - socially personal competence, PC - professional (instrumental) competence
4 Course Plan

Table 6.1 - Course topics

<table>
<thead>
<tr>
<th>№</th>
<th>Topic</th>
<th>Total hours</th>
<th>Classroom activities</th>
<th>Self-study</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lectures</td>
<td>Practice</td>
</tr>
<tr>
<td>1.</td>
<td>Mobile platforms (operating systems) and development software review.</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>Basic features and 3 ways of mobile application development.</td>
<td>6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>Basics of an application publication.</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Basics of mobile application analytics.</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>Mobile application analytics tools.</td>
<td>12</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>Using gestures. Built-in gestures and custom gestures. Gestures Builder.</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>Using third party libraries in mobile application. Different kinds of libraries. Application analytics libraries.</td>
<td>28</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Working with GPS.</td>
<td>14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>9.</td>
<td>Creating your own gallery.</td>
<td>14</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>10.</td>
<td>Developing a contact book with ability to call or text the book contact.</td>
<td>24</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>11.</td>
<td>Using DDMS, Cat Log, other systems. Debugging. Code reading and understanding.</td>
<td>13</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12.</td>
<td>Different speech recognition systems. Building an application with speech recognition.</td>
<td>26</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>13.</td>
<td>Analyzing one of the applications described.</td>
<td>13</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total:</td>
<td>190</td>
<td>18</td>
<td>22</td>
</tr>
</tbody>
</table>

5 Reading List

5.1 Required


5.2 Optional
5.3 Dictionaries, wiki

5.4 Software needed for students
Students need the following software installed to successfully study the course:
- Browsers: the latest versions of the Chrome, Opera, Firefox.
- The software mentioned in the 6-9 items of the 10.2 section of this document.
  MS Word 97 or higher / Apache OpenOffice 3 (OpenOffice.org Writer) or higher.

6 Grading System

Current control is evaluated as following:

\[ O_{current} = 0.6 \cdot O_{HA} + 0.4 \cdot O_T \]

The homework assignments (HA) mark is

\[ O_{HA} = 10 \cdot (1/7) \cdot \sum (O_{curi}), i=\{1,...,7\} \]

where

\[ O_{curi} = \{0,1\} \]

The written test (T) mark is

\[ O_T = 2 \cdot O_{answer} \]

where

\[ O_{answer} = \{0,1\} \]

So for example if a student has passed all the 7 laboratory assignments and answered correctly all the 5 test questions the \( O_{current} = 10 \) (using the 10 grade scale).

The final control is evaluated like

\[ O_{final} = 2 \cdot O_{answer} \]

where

\[ O_{answer} = \{0,1\} \]

If a student answered 4 questions of 5 total he gets 8 mark (using the 10 grade scale).

And the most final "result" mark of a student knowledge which goes to the master diploma is evaluated according to the following formula using the 10 grade scale:

\[ O_{result} = 0.6 \cdot O_{current} + 0.4 \cdot O_{final} \]
7 Guidelines for Knowledge Assessment

Table 7.1 - Forms of student knowledge control

<table>
<thead>
<tr>
<th>Type of control</th>
<th>Form of control</th>
<th>The whole year / modules</th>
<th>Parameters**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>Laboratory assignments/exercises</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>Current</td>
<td>Test</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Final</td>
<td>Examination</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

** Parameters specify a control format: written, oral, computer testing, timing, and what exactly a student should do to pass, etc.

7.1 Knowledge and skill estimating criteria

Current control consists of 7 laboratory assignments and 1 written test. Each assignment is evaluated as 1 if it has been successfully passed and as 0 if it was not (1 grade scale). The test is evaluated using the 5 grade scale. Each correct answer means getting 1 grade.

There is no intermediate control.

Final control means passing the examination and is evaluated using the 5 grade scale. Each correct answer means getting 1 grade.

The 5 grade scale used for written test and final control consists of 5 grades: 0 (failed: nothing was done, no questions answered), 1 (1 question was answered), 2 (2 questions answered), 3 (3 questions), 4 (4 questions) and 5 (5 questions, excellent answers).

As long as the National Research University Higher School of Economics has the 10 grade scale system all the results above are then transformed into the 10 grade scale as written in the 6 section of the document.

7.2 Current control sample tasks

The current control consists of 7 laboratory assignments.

Laboratory assignments basically match the lecture topics and can be as the following:

1. Develop an application which recognizes and shows any kind of sensor screen gesture supported by OS. The application consists of 1 activity which contains 1 TextView for the gesture name and parameters output. The application works as the following: a user makes one of the supported gestures and after that the TextView element shows what kind of gesture it was and some additional info about it.
2. Develop an application which helps to understand working with custom gestures and uses results of building custom gestures with Gestures Builder application. The application must recognize all the gestures having built before, and the TextView element should contain the successful and unsuccessful recognition results. The application consists of one activity with TextView and GestureOverlayView elements.

3. Create an application which can work with third party libraries, for example - with AChartEngine (https://github.com/ddanny/achartengine). Third party library can be any library but its crucial to use it in the application and make it work.

4. Develop an application which gets GPS coordinates of the device and informs about their changing. The application consists of an activity with 3 TextView elements: two of them show altitude and longitude of the device and the third shows the GPS module status: on, off.

5. Create your own image gallery. The gallery contains total number of images/pictures in a folder, the current number of the picture being shown and the next and previous picture buttons to navigate the gallery (Button or ImageButton or something else) together with the big picture itself in an ImageView element. The gallery can also contain some third-party elements like ability to zoom picture or horizontal list of thumbnails of the gallery pictures for easier navigation.

6. Develop a contact book. It should be able to give a user ability to add, edit and delete contacts, also user should be able to call the contact or text it using minimum number of taps. Usually the contact list looks like the name+number text and two buttons (can be ImageViews or ImageButtons) on the right in the same line: call, text.

7. Develop an application which can recognize a user's speech with some speech recognition engine (e.g. Google) and write it as an output in a TextView element. The application activity contains a Button and the TextView. After pressing the Button a speech recognition engine activates; if user pressed the Button element several times the TextView should contain multiple recognition results

8 (optional). Analyze your mobile application using one of the analyzing tool mentioned in the lectures (Google Analytics, Flurry, Crashlytics, etc.).

7.3 Sample questions for the final control

1. Basics of mobile application analytics.
2. 3 ways of mobile application development.
3. Special features of mobile development - what are they?
4. What are the tools for mobile application analytics? Which tools do you know?
5. How to put your application onto a market (Google Play, App Store)?
6. What features of an application are important to analyze? Which aren't?
7. How to analyze a third party application?
8. How to use a third party library in your own application?
9. How to make a call from one emulator to another? What number to dial?
10. Describe debugging abilities of an environment.
11. What libraries do you know for mobile application analytics?
12. Since what version of emulators (Android API) the Gestures Builder application appeared?
13. What is the difference between the built-in and custom gestures?
14. What is a permission for mobile application?
15. What permissions do you have to set in order to address a mobile device GPS module?
16. What is Cortana? What do you know about Siri?

8 Methods of Instruction

Classes of the course are conducted as the following forms:
- lectures/master classes of the computer presentation format;
- discussing various questions rising during the lectures, discussing them via email;
- practice (laboratory assignments in classrooms);
- self-studies with the help of the lecture presentations, software needed, internet, literature sources.

8.1 Recommendations for the lecturer

Lectures should be given in a presentation form which means a report followed by info- or just graphics shown with the help of presentation software and a computer connected to a projector and internet. Experience confirms that the presentation lectures are the most effective way to teach students during the course. The lecturer should consider giving lectures on how to make the laboratory assignments with several examples - how it should look and work and how it should not.

Each laboratory assignment is made by students on the grounds of the task itself and the according lectures which are given to students as a presentation software file if necessary. Each assignment passing is preparation to pass the exam. If student have questions considering the assignments the questions should be asked right away during the lecture. If they are not asked, the lecturer still should ask students if they have any questions regarding the lecture or assignments given.

When the lecturer tests students who are trying to pass any type of the controls mentioned above it is necessary for the lecturer to pay attention at the way each student tells about his work and answers the questions being asked about the code, lectures, etc. Questions should not be repeated from student to student. If a student can hardly answer some questions or the assignment result does not work or raises errors it is crucial to explain and help student about the code errors and how to avoid them, and give correct answer to the question asked with maximum amount of information and explanations (of course excluding the exam case), otherwise the student will keep coming with the same mistakes again and again.

8.2 Recommendations for the students

Students have to attend lectures because all the problems while working with the software, programming languages, ways and techniques of building and analyzing mobile applications, all laboratory assignments as long as examination questions are described and given in the lectures.

Implementation of each assignment should be different for each student. Having the same assignments doesn't mean the same interface including the application UI element position, styles and more because people are different.

Do not try to pass an assignment u have nothing to do about - it is obvious for the lecturer, and you know lecturers do not like copycats much.

Do not learn by heart all the answers to all the question to prepare for the exam because 1) all you need to do to prepare for the exam is to attend lectures and listen carefully; 2) there is no guarantee you will be given the questions you have learnt by heart (there are always some extra questions); 3) there are additional exam questions which are very possible including the assignment questions. That is why good work during all the course and lectures especially is a high exam mark guarantee.

9 Special Equipment and Software Support

Computer classes with MS Windows XP/7/8/10 and section 5.4 software - for the practice.
Classroom with good quality wi-fi or VGA/HDMI projector (not less than 1024x768 px) and Microsoft PowerPoint 2002 or higher installed on a laptop/notebook along with section 5.4 software - for giving lectures.