

MD framework, Approaches and Guidelines for Mobile Applications Development

S. Mahmood¹, B.Amen² and J. Lu³

¹Statistics and Computer, College of Commerce, University of Sulaimani, Sulaimani, Iraq

²School of Computing and Engineering, University of Huddersfield, Huddersfield, United Kingdom

³School of Computing and Engineering, University of Huddersfield, Huddersfield, United Kingdom

Abstract— the high demand and fast growth of smart devices apps have been introduced into the market regardless of their operating systems and platforms in the recent years. The mobile apps are designed to provide an efficient response to the user from touch screen despite of how the application has been developed. The fact, In order to design and to measure the quality of application standard, it's compulsory to have a strategic vision, mission and sets of core values. Meanwhile, based on having different issues in mobile application design, evaluating the requirements and finding appropriate solutions within mobile application are some of the crucial factors to design valuable applications. Although, conducting a set of guidelines and techniques for designing the standard application is an important approach in mobile application development. In this paper, we have proposed an extensive framework and details of how to conduct the new Mobile Design (MD) framework. Then, MD includes structural architecture, design guidelines, principles & concepts and techniques as four main elements.

Index Terms— Approaches, Design Mobile Apps, Guidelines, Principles and concepts, Techniques, User experience

1 INTRODUCTION

Mobile application development is one of the great revolutions in mobile technology "Digital Revolution" [16].

The unique measurement features and novelty of mobile application development is a quality of framework design to avoid devastate app's reputation and customers ratings in either App store or Google play [21]. Zhang and Adipat define that "developing mobile applications with an easy-to-use interface is critical for successful adoption and use of applications" [22]. There are various guidelines of "User Interface design", "Human-computer Interaction" and "usability" [14], to measure how easy the app can navigate the user. Meanwhile, having a useful, usable, desirable, findable, accessible, and credible user experience all together might provide a valuable user interface to design mobile applications [15].

One of the essential phases of mobile apps and software development methodologies is a Design. Through designers, different solutions have been evaluated and compromised to provide the high quality and user friendly mobile applications. Jacob and Tharakan define that 'to make the app more user-friendly, a QA ensures that the app is easily accessible' [10]. Further more, based on having more platforms and tools to develop mobile applications, it requires valuable techniques, approaches and guidelines to enhance the way how to design the helpful applications [13].

The rationale behind this paper is to review previous framework design and approach study will result of design a new MD framework (Mobile Design). MD framework is consist of four fundamental sections such as structural architecture, design guidelines, principles & concepts and techniques as shown in Figure 1. Through out this framework, it allocates designers to achieve desired result in terms of high quality of

user experience within mobile application development. This paper present and highlights each approaches, guidelines, principals, concepts and techniques that has been used to complete design processes in mobile application perfectly. In addition, analysis of previous study design and approaches assisted and guided us to achieve a new framework design (MD) that improves the efficiency and effectiveness of mobile application user interface design and user experience.

2 ANALYSIS DESIGN ISSUE

In order to achieve a highly standard reputation for your mobile application, the user expectation is the most fundamental parts of designing your application to discover your application's behavior in terms of user friendly and easy to navigate from one touch screen to a multiple operations on the smart device. At the beginning, when you decide to develop an app, it's essential to identifying a common design mistakes within mobile application development in order to avoid repeating same mistakes. Beside this, this paper focus on same or similar common design mistakes within mobile apps. Then, it illustrates better solutions for the common design mistakes from the following Table 1.

The complex and mistakes within mobile application development and framework design is frustrated and dissatisfied while developers only consider the application functionality rather than the application's framework design. Having no enough motivation, uncontrolled undertaking the problem faced the designers during design processes and idealistic expectations are other mistakes that occurred by the project designer [18]. Finally, one of the great solutions is having more experience within application design.

TABLE 1 DESIGN MISTAKES, SOLUTIONS IN MOBILE APPLICATION

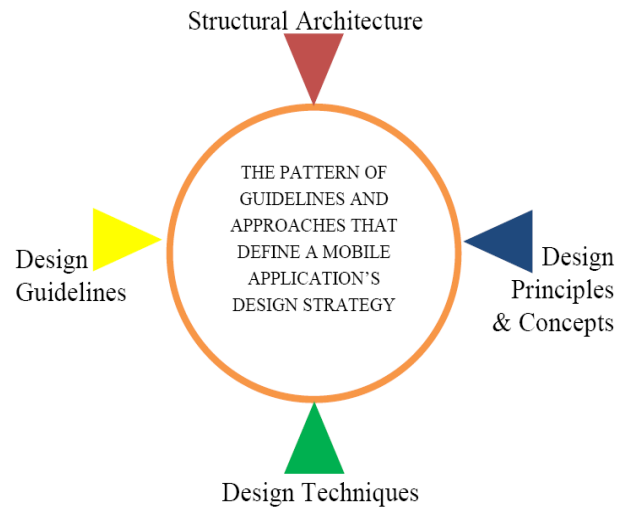
Design Mistakes	Solutions
Decision making quickly based on the gathered requirements without extensive analysis or filter the requirements	- refine the requirements - identify or prioritize the core requirements within the application development - review the prioritized requirements
Designing all processes or phases of the application (Detailed Design) at the beginning or as a first draft for the application design	- design the essential and fundamental sections at the beginning - Do not cover all the design process or detailed design at the starting point
Having no compatibility design process with other further essential changes and failure or disappoint to consider new changes	- integrate each sub section or decomposed together - consider any possible changes during the application development - design should be dependable, reliable and extensible
Unclearly and randomly state the design processes or screen designs	- clear state each sub section of design - merge all sub-sections Accurately
Undocumented design processes, steps and decisions from the beginning to the end of design phases	- document each design process and evaluate again and again due to enhance and improve the design decisions

3 MOBILE APPLICATION DESIGN

In mobile apps industry, the quality of application is reflects on the user’s prospective interms of beautiful graphics, simple interactions, easy navigate apps and high performance. The validation behind mobile application design is to organize and manage application’s complexity. Although, it’s necessary to improve the main factors of poor designs in (reusability, accessibility and user-friendly) that has a crucial impact on designing the application, because user have high expectations for the apps that they have interesting to download. Well-conceived design for mobile apps provides the desirable, focused and directional user interfaces for each specific section efficiently and accurately.

The MD framework is consisting of four core segments. The main idea of the fragment is that all the processes of design and decomposes has been integrated into some systematic approaches. In this section the MD framework segments has been summarized in more details. On the other hand, distinguishing between each sections are been identified in terms of high quality (user interface) of mobile application, high performance, usability, functionality and accessibility might be achieved respectively. Meanwhile, Figure 1 depicts the fundamental of mobile application framework phases.

FIGURE 1 MD FRAMEWORK



3.1 Structural Architecture

According to Haller indicated that “Architecture defines the components and their interplay” [8]. In fact, Architecture for mobile application is highly recommended and compulsory in developing standard application. For one obsession, to imagine what the expectations of an application are, through writing the programming statements or line of codes [11]. In the mean time, developers are looking to implement and develop an application within possible less time, while it would be hard for the user to look around your application and think about how to use it. In addition, in the very early stages of designing application and the easiest way to create a credible app is to implement a complicated application into some sub-sections. Therefore, in this section the architecture of an application has been classified into different categories as shown in Table 2. Through the following categories are the main centres of attention on the user’s content, in order to reduce complexity of the applications without decline capability.

TABLE 2 MOBILE APPLICATION ARCHITECTURE CATEGORIES

Categories	Descriptions
Decomposition of Components	- divide a system or an application requirements specification into sub systems or components - identify the essential components within an application architecture Ex: MVC Architecture
User Interface	- well-organize of an application’s Interface
Relationship	- prioritize the identified components - classify the relationship (hierarchical relationships) between component Dependencies
Functionality	- classify core functions within the application - describe the communications between each functions through using comments

	or labels
Up-to-date	- categorize a mechanism to update the functions within the application anytime

In addition, an architecture and model are the fundamental of overall system by collecting the entire decomposed components by putting every part of subsystems together. Then, repeatedly iterate the architecture design to obtain the final version architecture of the application [18]. Native clients, Java Platform Micro Edition (Java ME) clients, Web based clients, and middleware based clients are four fundamental approaches or sections that obligatory to be considered within the mobile application design [1]. Finally, more appropriate approach for this to use mobile application development methodologies through understanding and having knowledge about the entire mentioned approaches.

3.2 Design Principles and Concepts

There are various guidelines of operation systems and new features of mobile apps with a speedy growth of mobile technology and applications, those design, concept and guidelines are fairly useless due development methodology, new devices and network. The principle of design and concept to develop mobile application are readability, navigation, hotspots, pagination, button and call to action. In addition, it is crucial to make a comparison between some of the implemented user interfaces, and then design the new interface with more efficiency [5].

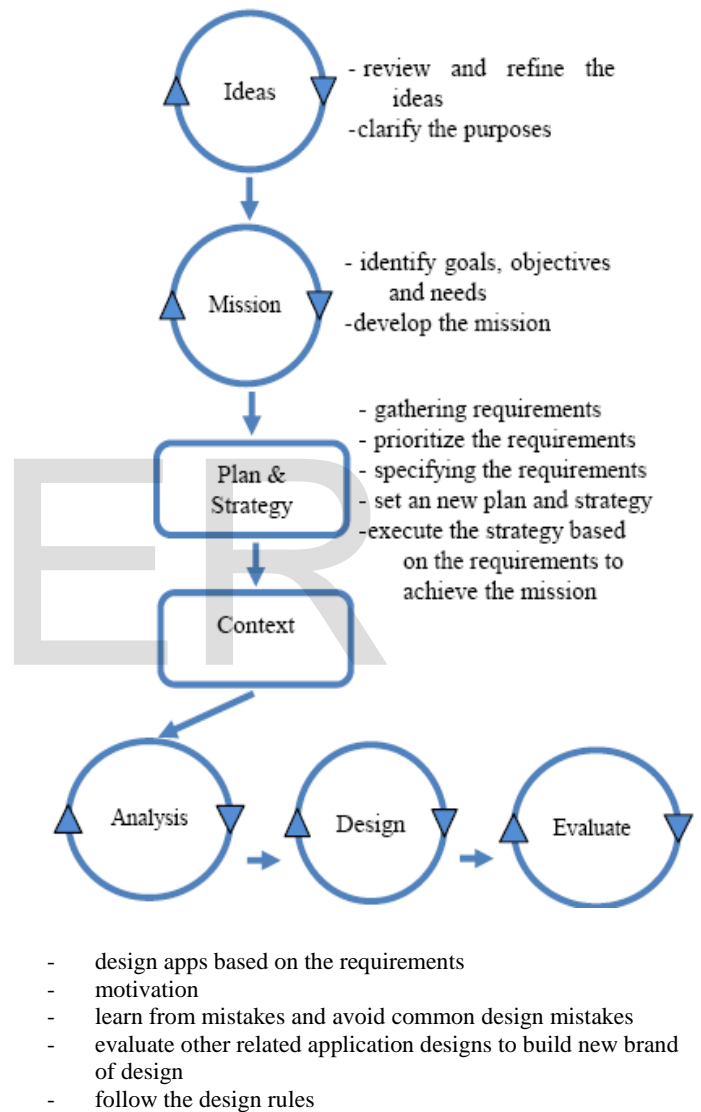
Meanwhile, some of the other points or tips should be measured to design mobile application such as providing the way of how to look and display on the native mobile apps. For that reason, native mobile apps are developed for the specific mobile device (device plan) within an operating system [12]. Moreover, dynamic keyboard interface based on the data input, which provides the usability to the end users. Based on macro steps of design process in software application development, this research identifies similar approaches in mobile application development that are initial and detailed design [17]. In fact, the initial design describes rich picture or real model for an application. As a result, it should be identified within the architecture of the application. However, each decomposed or divided sub systems must be specified or described within the detailed design. Both designs are examined to select an important design concepts or useful design principles for the application during the development phases [17].

One of the key concepts and principles is to distinguish between the essential characteristics and unessential during design of an application. At the same time, this does not allow designer to skip a critical and fundamental elements within an application [18]. Moreover, this examined as most fundamental and essential activities. Furthermore, optimization is other useful key concepts or design principles in terms of reducing the number of pages for the screen designs within an application as much as possible. Transparency (simplicity) for every steps and processes, assessment and evaluation for the application's design are other objectives should be considered within design phases for mobile application development [4].

3.3 Design Guidelines

Ayob et al. defines three layers design guideline for mobile applications that consist of analysis, design and evaluation [2]. According to Fling's ideas, goals and needs, context, strategy and device plan are other layers within a mobile layer experience [6] [7]. As a result, this research emerged both guidelines with vital changes into a new set of guideline layers for mobile application as shown in Figure 2.

FIGURE 2 MOBILE APPLICATION DESIGN GUIDELINE LAYERS



To design mobile application, above fundamental steps are desire to be taken into account as shown in Figure 2. Having a unique strategy is the key way to create or make differentiation design for the application. Moreover, this research introduces the notation of guideline layers to design mobile application. Table 3 indicates the Dos activities based on the elements to design user interface of mobile apps profitably.

TABLE 3 THE DOS GUIDELINE

Elements	The Dos
Color	- use appropriate colors based on the application's mission - utilize colors that close (related) to each other
Graphics	- employ various tools for graphical purposes to draw high quality graphics, images and icons
Media	- it is optional to have a sound for each clickable components - the sound should not be continued when any other action occurred
Context	- define users and their interaction within the application - focus on users data (analyzed requirements) to provide valuable services - present one idea at a time - define the way to present such as vertically (Portrait) or Horizontally (Landscape)
Layout	- structure the application effectively - have a right navigation based on the application - understanding the component on the screen and display in the acceptable ways
Screen Size	- identify the screen size based on the selective device plan for android or iOS platforms or either platform types - make sure that to follow the rules and guidelines in terms of screen size for mentioned platforms - test the application's screen size or design within a real device to be fit - knowing the screen size will increase the value of the application and will be fitted to the screen [12].
Alert	- demonstrate alert when the actions are done successfully. Meanwhile, when the error occurred the alert should be presented

On the other hand, the standard application should avoid to be colorful, to repeat the music during the application is running, and to use an appropriate layout within the same page (Not to be complicated). Moreover, to avoid doing common design mistakes has been identified within this research.

3.4 MVC Techniques

Model View Controller (MVC) as architecture and design pattern is an appropriate approach to break down or decompose a system or an application into sub systems. Then, it is more beneficial to distinguish between each layer. Then, each layer is responsible for a specific task within a system. However, in final section of MD framework, this research concentrates on view layer (object) within MVC due to demonstrate high quality user interface for a mobile application. Table 4 demonstrates of some techniques, descriptions and analysis each layers in more details.

TABLE 4 DESIGN TECHNIQUES OF MOBILE APPLICATION

Techniques	Descriptions
Rich Picture & Mind Map	- illustrate main keywords or ideas into graphical structure - add related ideas (branches) to the main keywords
Unified Modeling Language (UML) Diagrams	- relocate mobile application requirements into conceptual model - draw use-case diagram, sequence diagram, activity and class diagram - to provide and understand of each processes within an application
ClickStremms	- identify each single clicks or touch on screen within an application - depicts all call to actions in a graphical representation and show as architectural user interface of the application design process
Wireframes	- draw each frame with clear explanation labels - connect all frames together and show them as user interface of the application design
Screen design	- identify an outline of an application within different screen designs - sketch out the first draft [18] - reduce number of pages (screens)
Prototyping	- test the experiences and familiarities within the context of use, medium and analysis - make sure design is fitted on real Device
Documentation	- ensure to document final or fixed design before the implantation phase is beginning

Moreover, well-designed user interface should conclude these tests "fit screen test", "competitive advantage test" and "the performance test" [20]. As result, It's crucial to discover whether a mobile app operats on various device in terms of "Usability testing is a mandatory process to ensure that a mobile application is practical, effective, and easy to use, especially from user's perspective" [22]. Finally, achieve a high level of user satisfaction is critical to the success of mobile applications.

3 CASE STUDY

Several case studies are been illustrated in this research that has an impact on mobile application UI as a case study to determine the design processes before an application development being initialized. Furthermore, an evaluation for design approaches within mobile application development is improved significantly. From design perspectives Figure 3, is a wireframe for the **Trutap** mobile application. Trutap is a social communication app.

FIGURE 3 TRUTAP SAMPLE WIREFRAME FOR MANAGEMENT OF CONTACT GROUPS [9]

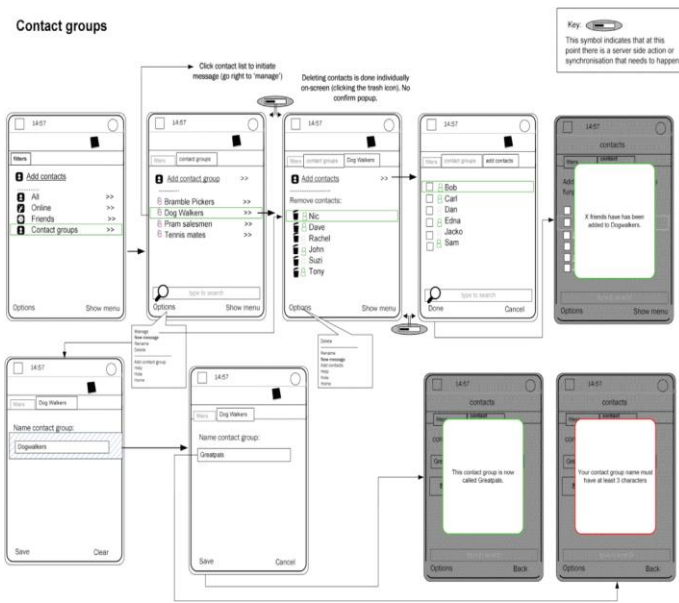
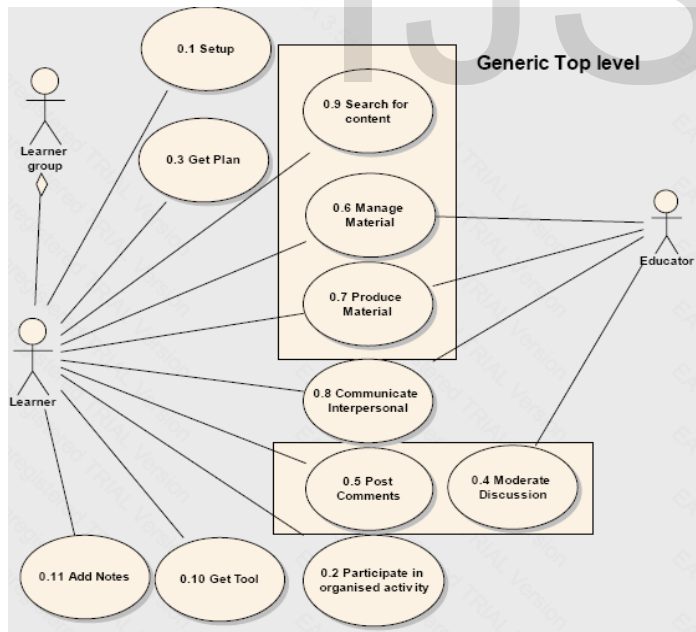


Figure 4, depicts the use case model of mobile application, and it is one of important diagrams within UML techniques.

FIGURE 4 GENERIC USE CASE MODEL [19]



The third case study is illustrating the user experience design (UX design) for Malta Culture Guide app. In this case study mockup paper design has been examined before to move on to the development level. As well as the app has been deployed and tested on both app and web app to see the designing result and the effectiveness of UX design method.

FIGURE 5 PAPER MOCK-UPS OF THE MALTA CULTURE GUIDE [3]



5 RESULTS

Various guidelines, principles, concepts and techniques reported and has been discussed in this research. In fact, it seems that this research investigated the core tips and points to achieve exceptional design for mobile application. New and validated approaches of MD framework should be available in a near future to deliver superior results in terms of design.

Furthermore, in the absence of a trusted mobile app and trusted operating platform, the result of capability pattern or MD framework has been achieved to design mobile application. A few selected designs are described to give examples of different types of design frameworks. As a result, the essential or fundamental design concepts and perfect design principles were two valuable approaches on certain aspects of the application within this research.

This MD framework has been conducted and implemented in several projects for instance "Online Doctor App (ODA)", "Students Attendance Tracking System (SATS)". Moreover, the framework has been conducted in study curriculum for 'Mobile Application Development Module' at the University of Human Development. Thus to successfully complete mobile apps, the developer and designer should carefully handle and balance this four main elements of MD framework, while a major benefit of conducting MD framework were been achieved in each of above projects through out of each MD phases of designed, implemented, tested and evaluated in terms of usability, functionality and accessibility of the applications.

6 EVALUATION AND ANALYSIS

This research was aimed to analysis and recommends crucial approach of how to design mobile application professionally. Moreover, the other objectives were based on most recent complex design and poor UI applications within application's stores. In addition, it's very challenging to present and design an appli-

cation that enables to operate on various platforms. Furthermore, based on extensive analysis of the structural architecture, design guidelines, principles & concepts and techniques within the MD framework made a desired and valuable results where has been achieved in this research.

Another point is to provide and offer effective resources for designing mobile application within different platforms. In designing MD framework the context, goals, needs and other guidelines were identified in Figure 2 and Table 3, to emphasis before the application development processes or phases initialize. As a consequence of MD framework, the design process must begin before development, implementation and testing in large numbers of practical methodologies within an application development. In MVC Architecture objects, each layers or objects have been separated, related items or components for each layers were given enough value to be worked on separately.

From authors paperprospective's of designing mobile application, designers must primarily considering on the simplicity of structure and activities for the application. Then, mobile app designers has to consider perivuos study of effective measurement to design an application for specific platform, the designer has to apply standard rules and guidelines of conducted platform. Furthermore, the application should be designed based on the standard of designing mobile application within the technology trend. Finally, designer should learn from their mistakes and design for error [18].

6 CONCLUSION

To sum up, this research examined to the readers how to conduct MD framework, this new framework phases of (structural architecture, design guidelines, principles & concepts and techniques) are inspiring designers to conduct extensive strategy in order to complete their designing mobile application. Then, being able to explain and identify the key features and core values in terms of how to design mobile application for various platforms. Different resources and fundamental sections were discussed to keep mobile application designs simple (user friendly) usable (usability) and accessible (accessible at any time anywhere).

Merging all the identified essential sections has a great impact on the mobile application in the market stores for each operating system. Consequently, the designing phase takes in a significant role during the mobile application development process. Hence, effective strategy needs to be applied based on break up designing process or user interface into application development phases such as Implementation, Development and Testing. In our future work, for the strong benefits of MD framework core values, we will illustrate and conduct this MD framework for a different user groups, with different application specifications such healthcare and game apps.

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