KADIR HAS UNIVERSITY

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TOWARDS A RAPID MOBILE APPLICATION DEVELOPMENT ENVIRONMENT

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Abstract

The impact of mobile technologies on our lives is increasing everyday. If we look at recent years, mobile phone sales have increased tremendously, so the applications in the respective marketplaces as well as usage of their mobile operating system. This proves the importance of mobile technologies in human's life. If we look at the statistics about usage of mobile applications after a long-time competition we can see two big brands: iOS based iPhones and Android devices. Therefore most of the programmers and web developers turn their way to mobile sector. The two problems that occur in this situation are long processing times and different programming languages. Developers have to spend a lot of time in order to create an application and they also need to learn a completely different programming language. The solution for these problems is this: creating a common platform or a system that can be even average programmers. This solution decrease waste of time and increase developer's efficiency. In this study we propose a general framework independent from any platform and demonstrate its partial usage for iOS based applications.

Keywords: Mobile Applications, iPhone Application, Rapid Application Produced, Mobile Market.

Özet

Mobil teknolojilerin insan hayatı üzerindeki etkisi günden güne artmaktadır. Son yıllara baktığımızda hem mobil markaların pazar payındaki artış anlamında hem telefonların satış oranları hemde işletim sistemlerinin kullanım sayısı ve uygulamaların sayısının çoğalması bunu bize ispatlamaktadır. Mobil uygulamalar konusunda yıllarca süre gelen rekabetin ardından istatistiklere baktığımızda iki marka öne çıkmaktadır iOS işletim sistemine sahip iphone telefonlar ve Android işletim sistemine sahip cihazlar. Dolayısıyla programcılar ve web geliştiricileri bu iki platforma yönelmektedirler. Burda ortaya çıkan sorun her bir uygulama geliştirmenin günler sürmesi ve her seferinde geliştiricelerin farklı diller öğrenmek zorunda kalmalarıdır. Bu sorunu aşmak için ortak bir dil üzerinde ya da hiçbir dil bilmeden bir araç vasıtasıyla uygulama oluşturacak bir platform ya da sistem yapılması hem geliştiricilerin önünü açacak hemde performansı arttırıp zaman kazandıracaktır. Bu çalışmada ortak bir uygulama geliştirme çerçevesi sunulmaktadır ve çerçevenin kısmi bir uygulaması olan iOS tabanlı iPhone telefonlar için gösterilmektedir.

Anahtar Kelimeler: Mobil uygulamalar, iphone aplikasyon, hızlı uygulama geliştirme, mobil market.

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List of Abbreviations

XML	Extensible Markup Language
SMS	Short Messaging Service
CEO	Chief Executive Officer
XG	X^{th} generation (X = 1,2,3,4,5)
GSM	Global System for Mobile communications
GPRS	General Packet Radio Service
WAP	Wireless Application Protocol
IMT-A	International Mobile Telecommunication-Advanced
ITU	International Telecommunication Union
IDE	Integrated Development Environment
HTML	Hyper Text Markup Language
CSS	Cascading Style Sheet
JS	Java Script
JSON	Java Script Object Notation
IOS	IPhone Operating System
OBJ-C	Objective-c

Chapter 1

Introduction

1.1. Research Objectives

This study suggests an idea of a framework for rapid mobile application development to solve problems of learning a new language and long development cycle. In software engineering there are many steps to complete a process. This is too time consuming [1]. Industrial side technologies develop rapidly. Therefore one may use the suggested ideas as a service to decrease time, budget and exertion.

Understanding the aim of this study some concepts should be understood clearly. First of all we will talk about the history of cell phones and the importance of mobile markets.

Mobile phones are one of the most significant inventions of the 20th century. Starting with late 90s, mobile phones have become the most important communication devices. The evolution can be defined in four ways, as will be detailed under history of mobile technologies section.

Moreover, the market of mobile phones should be reviewed with the evolution of cell phones. The number of mobile phone users has increased to over 4 billion in the last twenty-two years. Actually, the break point of this number is the entrance of smart phones to the market. In parallel to this, the increase on the mobile phone users affects the market shares of manufacturers.

During this evolution, many operating systems have appeared. As a result of this rapid growth, some of them have fallen back. Currently, there are two most common operating systems that have the biggest market share. Those are IOS and Android. The details of them will be given at later sections.

Also, the market of mobile phones is examined year by year according to some criteria like users, brands, developers, and tools of development environment.

Since IOS and Android have the biggest market shares, these two operating systems are popular among programmers. However, there is a truth that learning mobile programming languages require more effort compared to traditional programming languages. Therefore, there are some studies that focus on interface and application design rather than implementation. As a result, some universities have mobile computing courses based on these studies [2]. These universities have offered courses by using a tool named Cabana, [3] but nowadays it is not so much popular all around the world. Actually there are two tools that appeared as a result of these studies: PhoneGap [4] and Appcelerator [5].

Although those two platforms are popular, the common problem of them is that they require knowledge of a programming language. The aim of our study is to propose a framework to develop mobile application without knowing any programming language. However since developing such a framework is too time consuming. We show the concept and test its usability for one operating system namely iOS. The choice of iOS is due to its market share, the usage ratio and the difficulties to learn and implement [6], [7].

1.2. Thesis Structure

This thesis is divided into two parts: Theoretical study and technical study.

Part I (Theoretical study) sums up the literature about the subject. In order to support this study we used statistics and the choice of people about using the mobile technologies.

- History of Mobile Technologies and Mobile Market

- Mobile Markets and Brands

Part II (Technical study) is about existing technical solutions and better solution which is content of this study.

- Existing Tools for Application Development

- Rapid Mobile Application Development part of the suggested framework idea

Chapter 2

History of Mobile Technologies and Mobile Market

2.1. Objective

History of mobile technologies and mobile market are important issues in understanding why mobile programming is preffered rather than other software development areas. Mobile technology development provides the importance of engineering side of this study [17]. Mobile market improvement is related to the industrial side both economicacly and financialy [18].

2.2. History of Mobile Technologies

Mobile phones, also known as cellular phones, have become one of the most successful inventions of 20th century. In the late 90s, mobile phones became one of the major communication devices. From inventions of the cell phones, they can be divided into four periods according to their cellular wireless (figure 1). These periods are called;

- First Generation
- Second Generation
- Third Generation
- Fourth Generation
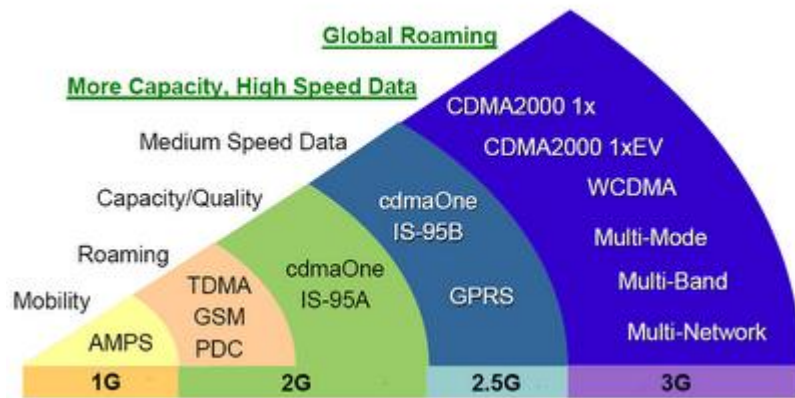
Figure 1: Comparison of 1G-2G-3G

2.2.1. The First Generation

Dr. Martin Cooper has invented the first hand-held mobile phone in April 3, 1973 as a brand of Motorola. The phone's weight was about 1kg and its battery lasted for about 20 minutes. That means, Motorola was the first company introducing first portable cell phone and it was called "Motorola DynaTAC 8000X".

"Cell phones became popular and received attention from the public during the period of 1983 to 1989. The innovations in communication technology and other networks include the ability of cell phones to handle calls from one area to another area way beyond the venue of the call. In the 1980s, a lot of cell phones were not designed to be hand-held. Formally, 'car phones' were installed in cars and this had high demand in the market. Aside from car phones, the earliest models of the first generation cell phones were shaped like tote bags. These were hooked up to the battery of the car through the DC outlet. Other models came in

the form of briefcases. This was for large batteries that were needed just in case the user had to make emergency calls" [8] .

2.2.2. The Second Generation

During 1990's a new technology appeared for mobile devices called the 2G was a second-generation wireless digital technology. 1G used analog signal for cell phone but 2G used digital signal and it made easier calls that is the major change. "2G on GSM standards were first used in commercial practice in 1991 by Radiolinja, which was a Finnish GSM operator founded on Sept. 19, 1988. Radiolinja is now part of Elisa, which was known in the 1990s as the Helsinki Telephone Company" [8].

2G phones differ from 1G phones in the way of their functionalities and appearances. Amount of cell phone usage rapidly increased according to some new features like batteries powerful and better computer chips integrated. Also, this technology was much more secured than the older technologies, for example the voice quality was encrypted strongly. SMS was one of the most important features in those times. The speed provided by this technology was approximately between 8 – 13 kb/s. That can be changed according to regions in the world but 2G is the most used communication services globally.

2.2.3. The Third Generation

Between 2G and 3G networks there was a 2.5G but it was like a bridge because it was less known. The most important feature of the 3G was to provide Multimedia services support. 3G networks provided faster data transmission. As a result of this streaming data became available. Cell phones that we use today are the types of mobile phones that was used the third generation phones. Also, 3G cell phones have set standards, which the network providers need to follow. These cell phones

could also message other users via SMS, send emails and access the Internet, stream live videos, stream radio, and use the Wi-Fi.

2.2.4. The Fourth Generation

The main difference between this standard and previous standard is speed of data transfer. With this new feature, mobile users reach more complicated data very quickly that include much bandwidth. The Fourth Generation, (4G) mobile technology, firstly became available in USA in 2009. There was no device that used 4G until 2011. "The main difference between 4G and previous standards is a big increase in data transfer speeds and the types of media people can access with it. There is an important standard named is IMT-A, which is written by ITU. According to this standard, all 4G mobile devices must be IP-based and able to provide data speeds of up to 100 Megabits per second (Mbps) when the device is being used while moving and up to 1 Gigabit per second (Gbps) when stationary" [8]. In 4G, whole devices have a capability to use digital voice and rich media like streaming videos. Also they have provided kind of security for the transmissions. There are 2 kinds of 4G technologies:

- WiMax
- LTE

"LTE services are faster than WiMax but WiMax can provide long-distance signals according to LTE. LTE is primarily used for cellphones and similar mobile devices, while WiMax is sometimes used to provide at-home Internet connections" [9].

Generation (1G,2G,3G,4G,5G)	Definition	Throughput/ Speed	Technology	Time period	Features
1G	Analog	14.4 Kbps (peak)	AMPS,NMT, TACS	1970 – 1980	During 1G Wireless phones are used for *voice only* .
2G	Digital Narrow band circuit data	20-40 Kbps	TDMA,CDMA	1990 to 2000	2G capabilities are achieved by allowing *multiple users on a single channel via multiplexing* .During 2G Cellular phones are used for *data also along with voice* .
2.5G	Packet Data	171.2 Kbps(peak) 20-40 Kbps	GPRS	2001-2004	In 2.5G the *internet* becomes popular and data becomes more relevant.2.5G *Multimedia services* and streaming starts to show growth.*Phones start supporting web browsing* though limited and very few phones have that.
3G	Digital Broadband Packet Data	3.1 Mbps (peak) 500-700 Kbps	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	2004-2005	3G has *Multimedia services support* along with streaming are more popular.In 3G, *Universal access* and *portability* across different device types are made possible. (Telephones, PDA's, etc.)
3.5G	Packet Data	14.4 Mbps (peak) 1-3 Mbps	HSPA	2006 – 2010	3.5G supports *higher throughput and speeds* to support higher data needs of the consumers.
4G	Digital Broadband Packet All IP Very high throughput	100-300 Mbps (peak) 3-5 Mbps 100 Mbps (Wi-Fi)	WiMax LTE Wi-Fi	Now	*Speeds* for 4G are further increased to keep up with data access demand used by various services.*High definition streaming* is now supported in 4G. New phones with HD capabilities surface. It gets pretty cool.In 4G, *Portability* is increased further.*World-wide roaming* is not a distant dream.
5G	Not Yet	Probably gigabits	Not Yet	Soon (probably 2020)	*Currently there is no 5G technology deployed* . When this becomes available it will provide very high speeds to the consumers. It would also provide efficient use of available bandwidth as has been seen through development of each new technology.

Table 1: Comparison of Mobile Networks

Chapter 3

Mobile Markets and Brands

3.1. Objective

Change of leaders of the brands in the global market and usage of the operating system in mobile devices affect to choice of the most convenience process in this study. That means why iOS and Android chosen instead of Symbian operating system or rather than another operating systems [15].

3.2. Mobile Market Improvement

In the last twenty-two years from 1990 to 2012, worldwide mobile phone subscriptions grew from 12.4 million to over 4 billion; it becomes a major force in economical pyramid. Actually these periods should be divided into 2 pieces and these are:

- Before the smart phones enter the market
- After the smart phones enter the market

Smartphone is a kind of mobile phone but additionally, it is built on mobile computing platform it has more advanced computing skills and connectivity than older mobile phones. Therefore, market share began to change when smartphones enter the market.

In 2008 smartphones has not started to obtain market share yet. According to ABI Research company; *"In terms of market share, Nokia has passed the 40% threshold for the first time (40.3%). Samsung secured second place with 15.2%, while Motorola barely managed to keep ahead of LG with its 9.3% versus LG's 9.2%, and both edged out Sony Ericsson (8.3%). There is a distinct possibility that*

LG might overtake Motorola by the end of 3Q of 2008, putting Motorola into fourth place." (figure 2) [10].

Figure 2: Mobile Device Vendor Market Share, 2Q 2008

Nokia and the other manufacturers did not know at that time that Apple's iPhone would change the rules of the mobile computation. According to a new report from Strategy Analytics, as seen below in table 2, not only the Apple iPhone recapture the global smartphone lead amazingly in fourth quarter of 2011, it also achieved its highest all-time market share amongst all mobile phones worldwide. With 8.3% of the global marketplace for all mobile phones, Apple followed the leaders of the market: Nokia (25.5%) and Samsung (21.3%). For the entire year, It is said Apple have sold 93 million copies of the Apple iPhone for a 6% slice of the pie (table 2).

Global Handset Vendor Marketshare (%)				
	Q4 '10	2010	Q4 '11	2011
Nokia	30.9%	33.3%	25.5%	26.9%
Samsung	20.2%	20.6%	21.3%	21.1%
Apple	4.0%	3.5%	8.3%	6.0%
Others	44.9%	42.6%	44.8%	46.0%
Total	100%	100%	100%	100%
Global Handset Shipments Growth Y/Y	16.2%	16.3%	11.2%	14.1%

Table 2: 2010-2011 Mobile Market Share in globally.

Top Five Mobile Phone Vendors in 2011

Nokia

In the beginning of last quarter of 2011, this company was leading the market successfully. The main reason of this success was selling phones in especially in China and Europe. However, there is a new Nokia Smartphone that is called Nokia Lumia and its operating system is Windows Phone 7. According to some assumptions Nokia can gain back its value in the global market in the coming two years with this smartphone.

Samsung

Samsung has a rapid increase on the market in this year compared to last year. Some wisely behaviors also have supported company's development. One of them was price cuts on smartphones like Galaxy S2. Sales of the smartphones have a magnificent increase in China and other countries. As a result of this rapid increase, Samsung have changed the characteristic of the market.

LG Electronics

This company's position was 3rd of the top mobile dealers in global market at the twelfth quarter. However, sustained light popularity according to both of submission cell phones and smartphones bring about levels of volume not seen since second quarter of 2007. Moreover, LG had some problems with creating new mobile phone portfolio and their shipment volume decreased at the end of 4th quarter. In the 4th quarter of 2011, LG's become number 3 because of Apple's edgy smartphone campaign that appears end of the year.

ZTE

This manufacturer is allocated to the 4th position of the global market, in the third quarter of 2011. ZTE almost doubled up the amount of smartphone sales, especially due to the sales in China. However, ZTE's phones which based on "entry-level-voice-centric", at AT&T have achieved higher position in North America. Also in the Northern American market area, ZTE's goal of 12 million smartphone transportation all over the world has become more real in 2011 with presentation of new Android based smartphones.

Apple

In these years Apple achieved popularity the third-highest enlargement Top 5 dealer about rating but globally fell into the 5th position. Steve Jobs who was the company founder, handed the control to Tim Cook as a CEO in that time. Apple accelerated the development by launching the 4S model of iPhone. Apple's capability to upgrade 4S for 3GS users, for instance and consciously target into developing economies and it has been not much successful, in the future it can be happened.

Vendor	3Q11 Unit Shipments	3Q11 Market Share	3Q10 Unit Shipments	3Q10 Market Share	Year-over-year Change
Nokia	106.6	27.1%	110.4	31.6%	-3.4%
Samsung	87.8	22.3%	71.4	20.5%	23.0%
LG Electronics	21.1	5.4%	28.4	8.1%	-25.7%
ZTE	19.1	4.9%	12.1	3.5%	57.9%
Apple	17.1	4.3%	14.1	4.0%	21.3%
Others	142	36.1%	112.5	32.2%	26.2%
Total	393.7	100.0%	348.9	100.0%	12.8%
Source: IDC Worldwide Mobile Phone Tracker, October 27, 2011					

Table 3: "Top Five Mobile Phone Vendors, Shipments, and Market Share, Q3 2011 (Units in Millions)"

3.3. Operating Systems and Languages

3.3.1. Operating Systems

Worldwide Smartphone Sales to End Users by Operating System in 1Q12 (Thousands of Units)

Operating System	1Q12 Units	1Q12 Market Share (%)	1Q11 Units	1Q11 Market Share (%)
Android	81,067.4	56.1	36,350.1	36.4
iOS	33,120.5	22.9	16,883.2	16.9
Symbian	12,466.9	8.6	27,598.5	27.7
Research In Motion	9,939.3	6.9	13,004.0	13.0
Bada	3,842.2	2.7	1,862.2	1.9
Microsoft	2,712.5	1.9	2,582.1	2.6
Others	1,242.9	0.9	1,495.0	1.5
Total	**144,391.7**	**100.0**	**99,775.0**	**100.0**

Source: Gartner (May 2012)

Table 4: Worldwide Smartphone Sales to End Users by Operating System in 1Q12

13

IOS (iPhone Operating System)

It's an operating system for Apple's mobile devices such as iPod touch, iPhone and iPad. Language of this operating system is Objective-C.

Sample objective-c code;

```
// main.m
#import
#import "Simple.h"
int main(int argc, char *argv[]) {
NSAutoreleasePool * pool = [[NSAutoreleasePool alloc] init];
Template *template = [[Template alloc] init];
[template sayHello:@"SnefeRu"];
[template release];
int sample = UIApplicationMain(argc, argv, nil, nil);
[pool release];
return sample;
}
```

It's quite hard to learn this language because of its semantic and syntax difference from other languages. The difficulty of language is an important problem but also some restrictions exist. The important restriction is that developers need an apple computer with Intel based processer. IDE that is called X-Code, only runs on Apple computers that have those features.

Android

There are many devices which use Android as an operating system. These devices are;

- Acer
- HTC
- LG
- Motorola
- Samsung
- Sony
- Sony Ericsson

These brands are for smartphones but Android is used also in tablets, e-readers, netbooks etc. because of this wide usage area Android at the first line on Gardner's statistic at table 4.

It's easier to make development on Android according to iOS because Android's language is Java and almost all platforms support this language to compile. The required IDE is eclipse and also this IDE can be run on almost all operating systems. Java is more common and easy to learn language that's c-based and syntax is similar to other languages.

Sample java code for Android:

```java
public class AndroidSample extends Activity {
  TextSample mTextSample = null;
  LinearLayout mLinearLayoutSample = null;
  Button mButtonSample = null;

  public void onCreate(Bundle savedInstanceState)
  {
  super.onCreate(savedInstanceState);
  mLinearLayoutSample = new LinearLayout(this);
  mTextSample.setText("5551222");
  mLinearLayoutSample.addView(mTextSample  _number);

  }
}
```

Chapter 4

Existing Tools for Application Development

4.1.   Objective

In mobile application development the most important problem is time consuming [16] when software engineering development processes are considered. However man power, cost and time also important issued in Industrial life. Apples update process also another important problem about timing. Every update process take a time like seven to ten days from submit binary file to approve for Appstore. Some existing tools find a solution of these problems although not perfect solution they have huge amount of usage.

4.2.   PhoneGap

Phone Gap is a platform that introduces web application that seems like a native for 7 platforms. These are iOS, Android, blackberry, windows, webos, symbian, bada but if developer wants to use it in Dreamweaver only 2 of it can be used iOS and Android.
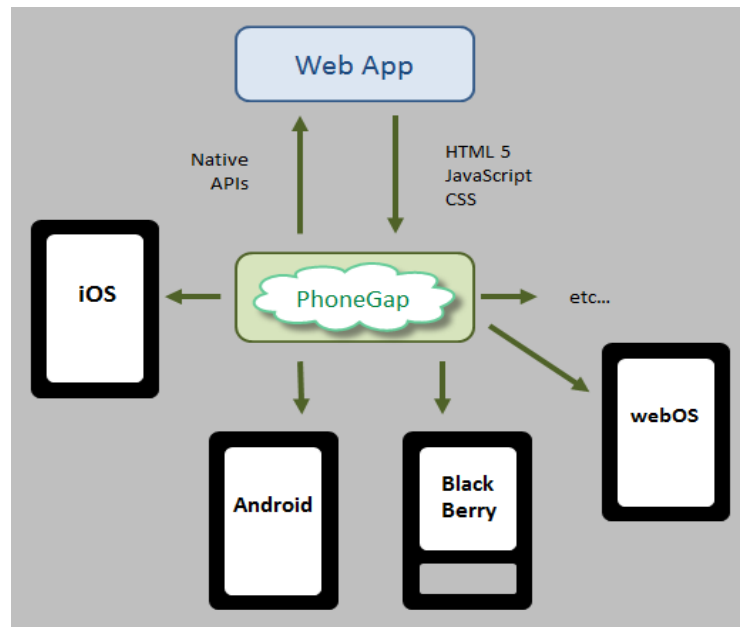
Figure 3: Process of PhoneGap

In this platform developers or users write HTML 5, CSS, JS codes to use this. Actually Phone Gap does not produce native applications (figure 3). For example in iOS there is a component that called UIWebView PhoneGap use this component and add some native feature like accelerometer, camera etc. Therefore basically this means is take a web application, run it in a UIWebView an through javascript that can access iPhone features. Phone Gap is totally free because its open source (MIT vs Apache open source license).

4.3. Appcelerator Titanium

Appcelerator is a platform that produces application for several operating systems like create iOS, Android and mobile web apps (figure 4). That means developers write a single code and then platform produces more than one application for different operating systems. Appcelerator use an IDE that based E-clipse so it is common and easy to use.

Figure 4: Appcelerator Titanium Sample

Developers use a javascript to write codes in Titanium. Titanium takes developers Javascript code, analyzes and pre-process it and then pre-compiles it into a set of symbols that are resolved based on applications uses of Titanium APIs. Appcelerator has a nice advantage according to phone gap that is producing native application. In the Phonegap, application is produced as a web based application and some additional features can be used but in the Appcelerator, application is produced as a native application. If the application is native then it becomes faster than others. One of the main advantages of creating a native mobile application is when the company releases new features; it is easy to integrate them for developers.

4.4. Cabana

Cabana provides rapid app development with visual choices (figure 5, figure 10). "Cabana lets you make truly custom feature rich mobile apps using an innovative visual approach" [2].
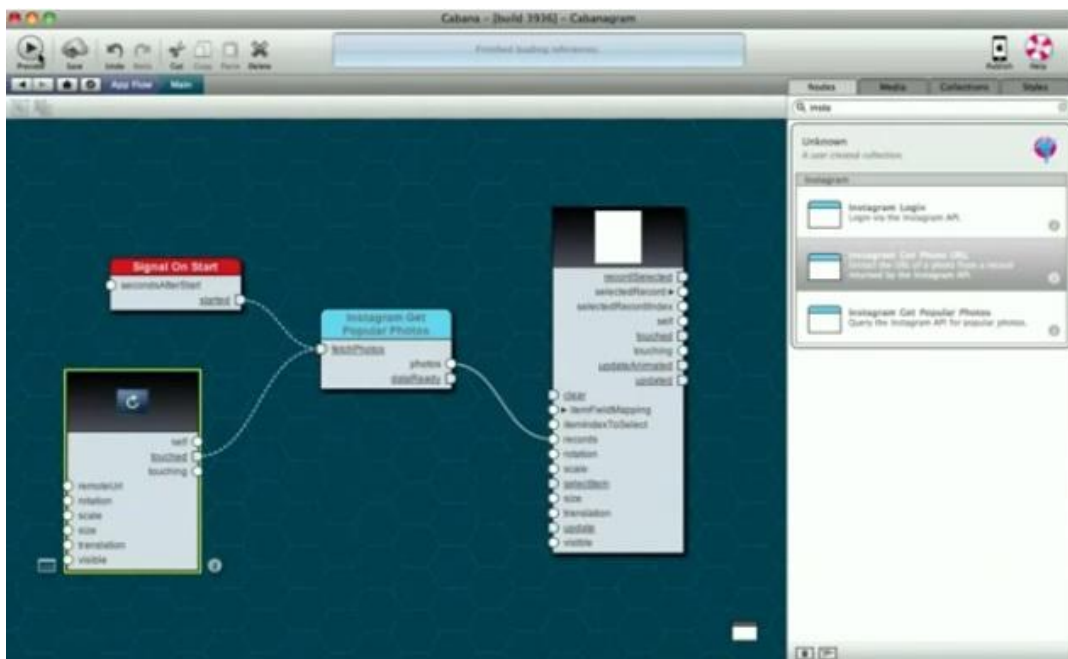
Figure 5: Sample process of Cabana

Figure 10: Cabana project result sample

Although it is not a highly popular tool, as mentioned above it is chosen by Hampshire College and courses are opened for students to learn it. Also some articles write about it. [1]

It also provides to be able to make an iPhone mobile application from the Facebook fan page. That means that user chooses his/her Facebook fun page and Cabana produces an iPhone application by using this. That's a unique feature which separates this tool and adds value from other tools.

4.5.   Difference of RMAD from other platforms

My project name is RMAD that stands for Rapid Mobile Application Development. This project does not produce any codes. The important advantages of this project are that developers or users don't need to know a programming language. In the PhoneGap or Appcelerator developers need to know some programming languages or web technologies like HTML5, CSS, JS etc. [11]. In this project developers do not need to know any programming languages there are two ways for developers & users;

- Developers can write a JSON for given format
- Users can use a web tool to create JSON

In this study, the first option has been completed totally; this option provides to users the ability to write a JSON based simple codes. After that, there is no problem about JSON formatting; the iOS project is created automatically by the Xcode projects, which are the results of this research. The second option is not finished because it needs additional sources such as more time, more finance but necessary structures like database design, JSON format, Xcode project is already finished.

With this solution development process time is decreasing significantly. Also some software engineering issues; coding, debugging, testing and maintenance totally remove from cycle for developers. Web services have an important role to remove these issues because of easy to use and integrate [12]. The most popular web services are XML and JSON. JSON is chosen in this project reason of it is faster when carrying a data and easier to learn from XML [13][14].

JSON file has a significant role in the RMAD process as a backbone of the system. "JSON is a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript Programming Language. JSON is a text format that is completely language independent but uses conventions that are familiar to programmers of the C-family of languages, including C, C++, C#, Java, JavaScript, Perl, Python, and many others. These properties make JSON an ideal data-interchange language.

JSON format is built in two parts:

- First part is values together with index and ordered like an Array as it is known most programming language. It is also list, vector or sequence.
- In the second part these arrays include values as an object. This object includes key/value pairs. In most programming languages, this is called as an object, dictionary, associative array, record, keyed list, hash table or struct.

"These are universal data structures. Virtually all modern programming languages support them in one form or another. It makes sense that a data format that is interchangeable with programming languages also be based on these structures"

In JSON, all values can be written in these formats:

- Object

An *object* is an unordered set of name/value pairs. An object begins with { (left brace) and ends with } (right brace). Each name is followed by : (colon) and the name/value pairs are separated by , (comma).
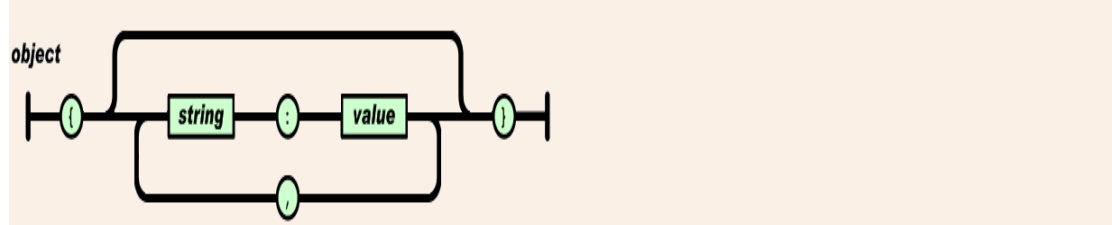
- Array

An *array* is an ordered collection of values. An array begins with [(left bracket) and ends with] (right bracket). Values are separated by , (comma).
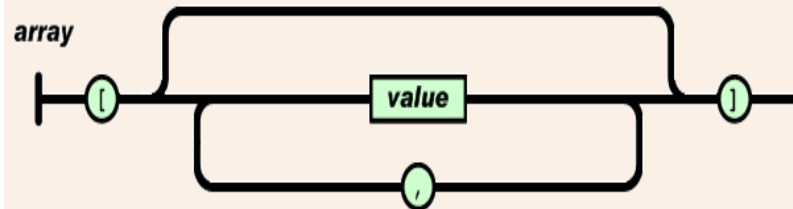
- Value

A *value* can be a *string* in double quotes, or a *number*, or true or false or null, or an *object* or an *array*. These structures can be nested.
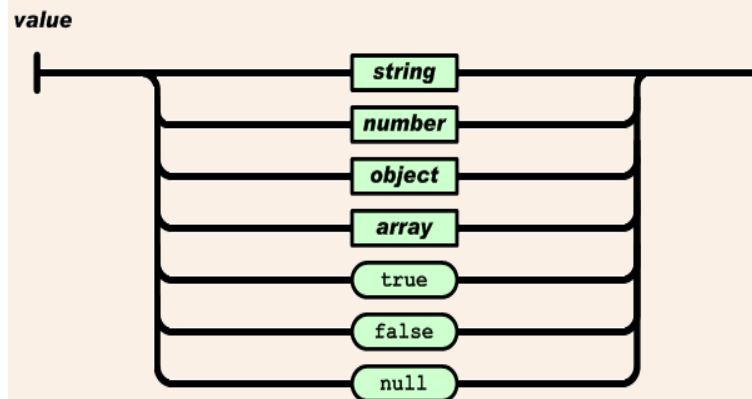
Chapter 5

Rapid Mobile Application Development

5.1 Objective

Technical part of solution is described in this part. Although web tool has not finish yet also it is mentioned how it works. Relation between databases, JSON file, XCode project are described detail and how to produce native application with this development system.

5.2 Processes of RMAD system

Rmad Project has four parts to complete process;

- Web Tool
- Database
- Json
- Xcode Project
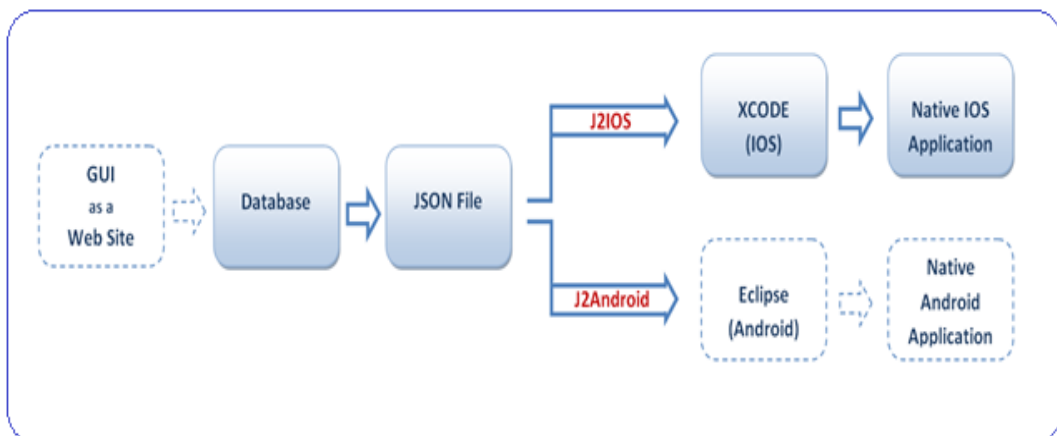
Figure 11: RMAD processes

First of all, the user accesses to the web tool to choose design and data source for application and then when s/he clicks to submit button all choices are saved in the database. After that, database creates a JSON data according to the data in tables. New copy of XCode project read the JSON n and processes it and new native iOS applications exist after these steps. At the figure 11 all targeted processes are given but when time and man power considered it is not possible to finish every process in this study. Therefore dashed process has not finish yet other process is already done. Now this study take the JSON data and produce native iOS application each time and when JSON data change iOS native application already change in a couple of seconds.

5.2.1. Web Tool

There will be a web tool that has two parts: design and data source choice. There will be a huge amount of attributes and options in both design and data source parts. In the design part frame of the component can be chosen as a coordinate of x and y, as well as dimensions with height and width options. Color of the component background and if the component has text property also color of text is selectable via color picker.

5.2.2. Database

Database has several tables exactly what json need. Ms-sql database is used in this project. It is widely and easily used and simply integrated.
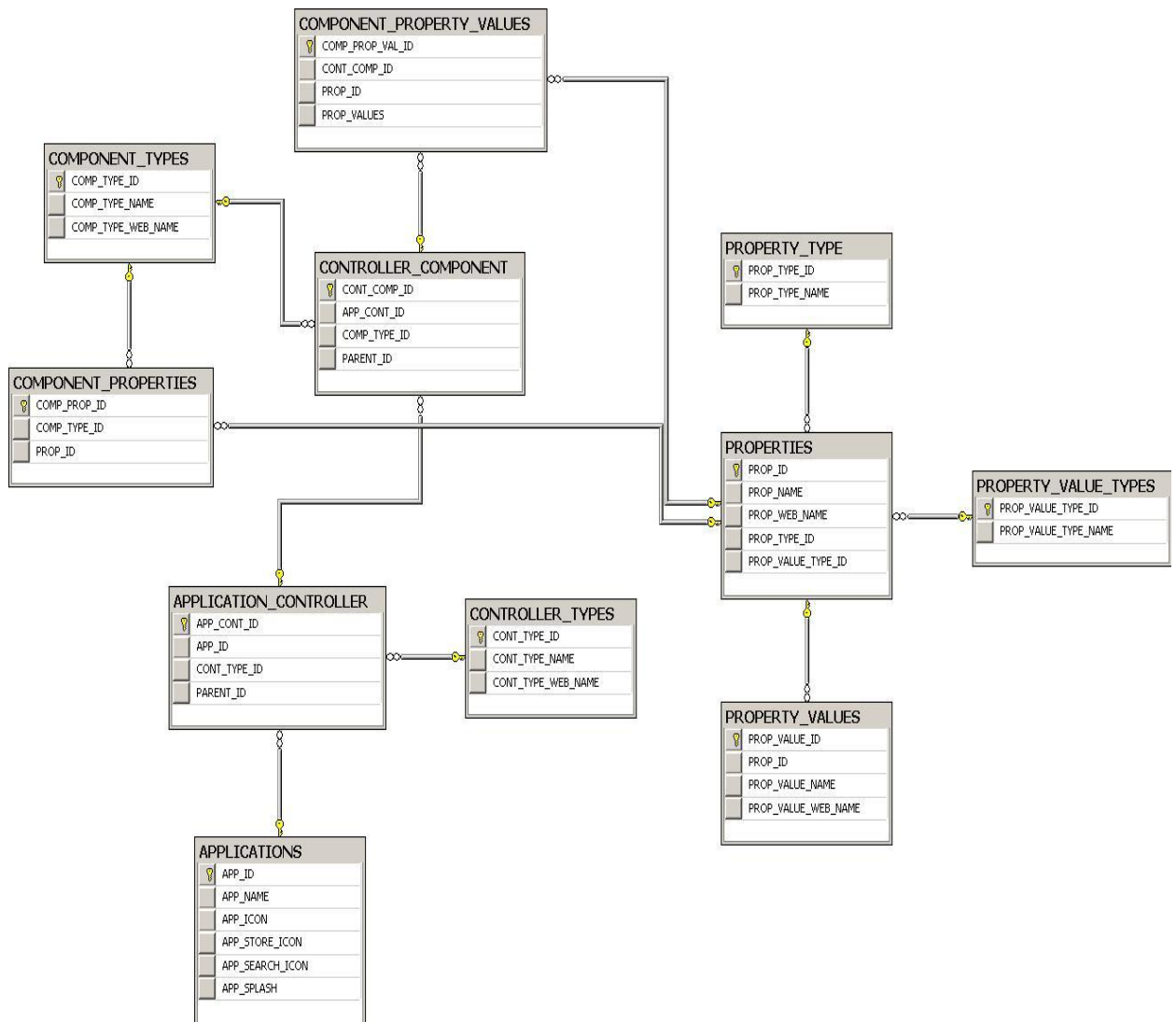
Database is directly creating a needed JSON when integrated with Web Tool.

5.2.3. Json

The most important part in this project is json because this part is the backbone of this system. Everything is connected with json. Every object in json indicates exactly native ios property for component that is used. Two types of json have to be created

First of all we need three parameters for url to send a request. These are version, bundle_version, app_id and url seems like;

http://rmad.com/sample.cfm?version=1&app_id=1234&bundle_version=1

Parameter	Value Type	Mandatory	Description	Example	Extra Info
version	int	Y	Unique Id of application	www.xyz.com/fed.cfm?version=1	Type of parameter int in xcode project but it is string in the web url.
bundle_ version	string	Y	It is the version of application shown in Appstore	www.xyz.com/fed.cfm?bundler_ version=1.0	It is necessary to understand which json serve from server side
app_id	int	Y	Unique id in database	www.xyz.com/fed.cfm?app_id=1	It is necessary to take json from database

After making a request by using the necessary url, database, it produces a response in JSON format. After the Xcode project reads this JSON file, then the finally desired application is created. Response parameters of json are explained in detail below:

Json Response Parameters

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_version	string	Y	According to this property application will update	201109141 00824	-
status_bar_hi dden	boolean	Y	Does status bar hidden all the time?	Yes/No	Status bar is seen top of the iPhone screen
status_bar_st yle	string	Y	Style of status bar	Black,gray, transparent	
default_indic ator_style	string	Y	Style of all ctivity Indicator	large_white	There is a component in IOS that called UIActivityIndi cator
default_font	string	Y	Default font type of all component that has text property	arial	

default_font_ size	string	Y	Default font size of all component that has text property	12	
controllers	array of objects	If it is a root -> Y others - > N	Its like a pages will show in application		Recursive parameter and it indicates UIViewControl ler types in ios sdk

Object of Controllers Parameters

Parameter(key)	Value Type	Mandatory	Description	Example (value)	Extra Info
controller_type	string	Y	Type of controller	tabbar_controller, navigation_controlle r, view_controller	
interfaceOrie ntation	array	N	Orientation types of devices that is support	default:portrait upsidedown, landscapeleft, landscaperight	
hidesBottom BarWhenPus hed	boolean	N	When navigate to controller if it has a tabbar this property made tabbar is	Yes/No	

			hidden		
selectedIndex	int	N	Which tab become selected	default: 0	
components	array of objects	Y			

Controller Types

Type	Definition	Extra Info
view_controller	It is the root controller of all controllers and it must have a view as a first child.	In JSON it must be; UIViewController -> UIView
tabbar_controller	It has a tabbar that manages more than one controller. This tabbar includes minimum 2 tabbaritem.	TabbarController -> UITabbar -> (array)UITabbarItems
navigation_controller	It gives capability of navigation to UIViewController. It has UINavbar by default. It has a title that appears on UINavbar and also it will become back button title when navigate to another UIController.	UINavigationController -> UINavbar , UIViewController

Object of Components Parameters

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
id	int	Y	It is a unique id of component.	1	This id has been used both of in DB and "tag" property of

					UIComponent in obj-c part.
component_type	string	Y	Name of the component in Library.	UIView, RMADTableView etc..	
[Component Properties]			It has multiple values; appropriate properties added from Component properties table.		All properties are not allowed. Only permitted ones can be used in here.

Components Types

Type	Definition	Extra Info
UIView	"The UIView class defines a rectangular area on the screen and the interfaces for managing the content in that area."	It is a root component. All other components inherit from it.
UITabBar	"The UITabBar class implements a control for selecting one of two or more buttons, called items. The most common use of a tab bar is to implement a modal interface where tapping an item changes the selection	Since UITabBar inherits from UIView, it has all properties of It.
UITabBarItem	The UITabBarItem class implements an item on a tab bar, instances of the UITabBar class	It inherits from NSObject.
UIActivityIndicatorView	Use an activity indicator to show that a task is in progress.	It has all properties of UIView.
RMADTableView	An instance of UITableView	Inheritance order;

	(or simply, a table view) is a means for displaying and editing hierarchical lists of information	UITableView:UIScrollerView:UIView
UITableViewCell	The UITableViewCell class defines the attributes and behavior of the cells that appear in UITableView objects	Inheritance order; UIView : UIResponder : NSObject
RMADImageView	An image view object provides a view-based container for displaying either a single image or for animating a series of images	Inheritance order; UIImageView:UIView : UIResponder : NSObject
UILabel	The UILabel class implements a read-only text view	Inheritance order; UIView : UIResponder : NSObject
RMADButton	An instance of the UIButton class implements a button on the touch screen.	Inheritance order; RMADButton : UIControl : UIView : UIResponder : NSObject
UINavigationBar	The UINavigationBar class implements a control for navigating hierarchical content.It's a bar, typically displayed at the top of the screen, containing buttons for navigating up and down a hierarchy. The primary properties are a left (back) button, a center title, and an optional right button. You can specify custom views for each of these"	Inheritance order; UIView : UIResponder : NSObject
UITextField	"A UITextField object is a control that displays editable text and sends an action message to a target object when the user presses the return button. You typically use this class to gather small amounts of text from the user and perform some immediate action, such as a search operation, based on that text."	Inheritance order; UIControl : UIView : UIResponder : NSObject

UITextView	"The UITextView class implements the behavior for a scrollable, multiline text region. The class supports the display of text using a custom font, color, and alignment and also supports text editing. You typically use a text view to display multiple lines of text, such as when displaying the body of a large text document."	Inheritance order; UIScrollView : UIView : UIResponder : NSObject
RMADReleaseToRefreshView	It is not a native component of iOS library. It is created for this project to use.	Inheritance order; UIView : NSObject
ReleaseToRefreshStatusLabel	It is like UILabel but has more properties.	Inheritance order; UILabel: UIView

Component Properties

UIView

Parameter (key)	Value Type	Mandat ory	Description	Example (value)	Extra Info
bg_color	string	Y	Background color of component	"ff0033" default value: white "clear_color"	It takes hex value from web but this framework convert to RGB value in programming side. If it is value "clear_color" that means transparent.
x	int	Y	x coordinate of frame	5	
y	int	Y	y coordinate of frame	10	
height	int	Y	Height of frame size	100	

width	int	Y	Width of frame size	320	
alpha	float	Y	Transparent degree	0.0 <-> 1.0	1.0 -> not transparent (default value) 0.0 -> full transparent
indicator_id	int	N	UIActivityIndicator id of that is subchild of view	35	It is given to find Indicator with its id.
all_data	object of array	Y	All data; like url, text etc keep in here	"url" : "http://www.nevzatraytop.com/rss", "image_url" : "http://www.design.org/button.jpg, "prev_cont" : " "	key -> data_ type value -> data_value
nav_bartitle_source	string	N	Source of navbar title's data	plain_text, from_cell -> taken from cell when controller pushed by selected cell	
nav_bar_title_data	string	N	Navbar title data value	"homepage"	
back_button_title_source	string	N	Source of navbar back button title data	plain text	
back_button_title_data	string	N	Value of navbar back button title	"back"	

UITabBar

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
background_image	string	N	Background image url of UITabbar	http://www.resimler.com/pic.jpg	Support iOS 5 and above
selected_image_tint_color	string	N	The tint color to apply to the gradient image used when creating the selected image.	ffaa33	Support iOS 5 and above
tintColor	string	N	Background color of UITabbar	ffaa33	Support iOS 5 and above

UITabBarItem

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
icon_url	string	Y	İcon that appear on UITabbar	more, search or http://www.icons.com/icon1.png	
icon_text	string	Y	Title of this item	"videos", "news"	If "icon_url" has not include

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
					weburl this property not necessary to use.
action_index	string	Y	It is an index of array of controller. Which controller is opened when this item clicked.	3	
action_type	string	Y	How the controller appear when this item clicked.	default, navigation, flip vs.	

UIActivityIndicatorView

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
indicator_style	string	N	Type of UIActivityIndicatorView	gray(default), white, large_white	
color	string	N	Background color of UIActivityIndicatorView	ff4411	İf this property used it overrides "indicator_style" property. **Support iOS 5 and above**

RMADTableView

Parameter (key)	Value Type	Manda tory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	Y	What kind of data source exist?	xml, xml_node, image,array	
data	string	Y	It has multiple value. It can be index value or directly value itself.	0, rss.channel.ite m,<root>	İf it is an xml attribute "-" needed to add.
seperator_styl e	string	N	Style of cell seperator	none, single_line(def ault), single_line_etc hed	
seperator_col or	string	N	Color of seperator	ff4433	
has_releasetor efresh_view	boolean	Y	It has release-to-refresh functionality or not?		
release_to_ref resh_view_id	int	N	If "has_releasetoref resh_view" property's value equals to true, It must be defined.		Id of RMADReleaseToRefresh View
has_loadmore	boolean	Y	Load more functionality added?		Add a button at the end of table view to show more content.
load_more_tit le	string	N	If "has_loadmore" property's value equals to true, It must be defined	"show more content"	

UITableViewCell

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	Y	What kind of data source exist?	xml_node	.
data	string	Y	It has multiple value. It can be index value or directly value itself.	a.b.c.status	If "data_type" equals to "xml_node" all nodes must be seperated with "."
action_index	string	N	Which controller opened when cell selected	0,1,2...	
action_type	string	N	How controller opened when cell selected	navigation	
accessory_type	string	N	arrow style in cell	none (default), disclosure_indicator, detail_disclosure_button, checkmark	If action parameter does not used this property can not be used.
selection_style	string	N	Background color of cell when it is selected	none, blue(default), gray	If there is no selection action this property must be set "none" value.
row_height	int	Y	Height value of cell	44	
data_for_send	array of	N	All datas keep in	"data_type":	

	objects		here to reach another controller.	"text_from_paren t_node",	
				"data": "media:content- url",	
				"at _index": 0	

RMADImageView

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	Y	What kind of data source exist?	xml, xml_node, image	
data	string	Y	It has multiple value. It can be index value or directly value itself.	0, rss.channel.item	It is a "image" property in iOS library.
indicator_id	int	N	After image loaded indicator will be stop with this indicator_id used.		

UILabel

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	Y	What kind of data source exist?	xml, xml_node, image	
data	string	Y	It has multiple value. It can be index value or directly value itself.	0, rss.channel.item	It is a "text" property in iOS library.
font_size	int	N	Punto of text	17.0(default)	
font	string	N	Type of punto	Arial, system(default)	If it is bold; "Arial-BoldMT"
text_color	string	N	text color	ff3322	
text_aligment	string	N	Text aligment	left, right, center	
line_break_mode			How lines separated from each other		
minimum_font_size	int	N	İf text not fit in the frame this punto used	default:11	
number_of_lines	int	N	How many lines allowed maximum	default:1	

RMADButton

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	Y	What kind of data source exist?	xml, xml_node, image	
data	string	Y	It has multiple value. It can be index value or directly value itself.	0, rss.channel.item	It can be "text" or "image "property in iOS library
action_index	int	Y	Which controller is opened when button clicked.	2	
action_type	string	Y	How the controller appear when this button clicked.	cover_vertical,cross_dissolve,flip_horizontal,partial_curl	
text_color	string	N	Color of button title	ff5566	
tint_color	string	N	Button selected text color	ff5566	
image_url	string	N	If button needs to image to customize	htttp://imageworld.com/image.png	
background_image_url	string	N	Button background	http://www.webdesign.org/img_articles/17173/but	Also text can be seen in this

			image	ton-with-reflection.jpg	property
title_shadow_color	string	N			
data_for_send	objects	N	All datas keep in here to reach another controller.	data_type": "text_from_parent_node" , "data": "media:content-url", "at_index": 0 }	

UINavigationBar

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
tint_color	string	n	Color of this bar	"ff3344"	

UITextField

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	Y	What kind of data source exist?	xml, xml_node, image	

data	string	Y	It has multiple value. It can be index value or directly value itself.	0, rss.channel.item	It is a "text" property in iOS library
place_holde r	string	n	It is appear before user enter a value to help them	"enter a name"	
text_color	string	n	Color of text	"ff4455" default: "ffffff"	
text_aligme nt	string	n	Text aligment	default:left, center, right	
border_style	string	n	border style	none, line, bezel, default: roundrect	

UITextView

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
data_source	string	Y	Where the data take from?	data_array, parent_node	
data_type	string	y	What kind of data source exist?	xml, xml_node, image	
data	string	y	It has multiple value. It can be index valur or directly value itself.	0, rss.channel.item	It is a "text" property in iOS library
text_color	string	n	text color	"ff4455" default: "ffffff"	
text_alignment	string	n	Text aligment	default:left, center, right	

RMADReleaseToRefreshView

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
y	int	Y	In this component only y coordinate change	- 100	
components	array	Y	Normally this property optional but in this plugin 3 component must be defined!	RMADImageView, UIActivityIndicatorView, ReleaseToRefreshStatusLabel	
arrow_color	string	Y	There is an 4 type arrow	red, black, white, gray	

ReleaseToRefreshStatusLabel

Parameter (key)	Value Type	Mandatory	Description	Example (value)	Extra Info
release_text	string	Y	When user start to release this component text value	"release to update"	
refresh_text	string	Y	When user finish to release this component text value	"refresh to finish"	
loading_text	string	Y	When process start; text value	"loading"	

5.2.4. Xcode Project

There is an Xcode project to make applications with using objective-c code. This project already created. It takes the specific JSON that belongs to application and converts it to objective-c code to make native application. The amount of classes is big and thousands line of codes appear in it.

It works as a code generator there is a stabile objective-c code and each time it produces different application. With this process developer only needs to change JSON data and don't concern about coding, debugging, testing and update issue.

Conclusion

In this thesis, how to develop a mobile application in iOS platform without knowledge of any programming language is examined. First of all, the history of mobile technologies and importance of mobile marketing in the global economy is analyzed with some statistics and real values.

The process of developing mobile applications is very long and difficult to learn. However, some universities solve this problem by using other tools. These difficulties and solutions are supported with some academic researches and articles.

Popular solutions like Appcelerator and PhoneGap are also mentioned in this study. Advantages and disadvantages of them are compared.

Finally, solutions provided by these methods and their differences from others are discussed. How to process the solutions of them are explained step by step. For example, database part, web services part and programming part. How to create a JSON in correct format is explained in detail for users.

There are two limitations in this research. The first one is the fact that it is done only for iOS, although there are several others mobile OS. The second one is that users should follow our JSON structure concerning the format.

As a further research, a mobile application via a web interface without knowing JSON structure should be created. Thus, the database, that was created already, should produce the necessary web interface. As a result of this, even a user who would have no skills in programming could develop an application for mobile.

References

[1] Hazzan Orit, Dubinsky Yael, (30-31 Oct. 2007). The Software Engineering Timeline: A Time Management Perspective. Software-Science, Technology & Engineering, 2007. SwSTE 2007. IEEE International Conference. pp (95 – 103)

[2] Paul E. Dickson, (June 2012). Teaching mobile computing using Cabana. Journal of Computing Sciences in Colleges , Volume 27, Issue 6, pp 128-134

[3] Department of Behavior and Logic Inc., (November 2011) Cabana - Create mobile apps withCabana! , Web site: http://www.cabanaapp.com/features/

[4] iPhoneDevCamp, (November 2011). San Francisco, Web site: http://phonegap.com/about/feature

[5] Appcelerator Inc. (December 2008). Web site: http://www.appcelerator.com/

[6] Rogers, M. P., (June 2010). Wrong number: avoiding the hidden perils in iPhone development, Journal of Computing Sciences in Colleges, Volume 25 Issue 5, pp 300-305.

[7] Ivanov, L., (2011). The I-phone/I-pad course: a small college perspective, Journal of Computing Sciences in Colleges, Volume 26 Issue 6, pp 142-148.

[8] (December 2010). History of cellphones. Web site:
http://www.historyofcellphones.net/

[9] John Lister, (June 2012).What is 4g mobile technology .Web site: http://www.wisegeek.com/what-is-4g-mobile-technology.htm

[10] ABI research, (August 2008). Global Mobile Device Market Still on Course for 1.3 Billion Units Despite Economic Woes. Web site: http://www.slashphone.com/2008-global-mobile-device-market-still-on-course-for-13-billion-units-despite-economic-woes-011087

[11] Johann Dowa, (2011). Appcelerator Titanium Mobile vs. Phonegap Web site: http://maniacdev.com/2010/10/appcelerator-titanium-mobile-vs-phonegap/

[12] Adel Ben Mnaouer, Anand Shekhar, Zhao Yi Liang, (15-18 Sept. 2004). A generic framework for rapid application development of mobile Web services with dynamic workflow management. Services Computing, 2004. (SCC 2004). Proceedings. 2004 IEEE International Conference on . pp (165 – 171)

[13] Guanhua Wang , (18-20 April 2011). Improving Data Transmission in Web Applications via the Translation between XML and JSON. Communications and Mobile Computing (CMC), 2011 Third International Conference on. (Pp 182 – 185)

[14] Maeda K., (16-18 May 2012). Performance evaluation of object serialization libraries in XML, JSON and binary formats. Digital Information and Communication Technology and it's Applications (DICTAP), 2012 Second International Conference on. (Pp 177 – 182)

[15] Peter Grundström (2010). Mobile Development for iPhone and Android. A comparison of 3rd party development for the iPhone and Android platforms. Bachelor of Science Thesis Stockholm.

[16] Xu, J. (Aug. 2003). On inspection and verification of software with timing requirements Software Engineering, IEEE Transactions on. Volume 29 Issue 8, pp 705 - 720.

[17] Yamakami, T. (11-13 July 2005). Mobile application platform strategies: business model engineering for the data intensive mobile age Mobile Business, 2005. ICMB 2005. International Conference on (Pp 333 – 339)

[18] JidongHan Dong Cheng ; Yuanfang Song . (30-31 May 2010). What affect the acceptance of mobile marketing? Networking and Digital Society (ICNDS), 2010 2nd International Conference on Volume 2, pp 528 - 531.

Curriculum Vitae

Nevzat Raytop was born in May 23th, 1985, in Istanbul. He received his BS in Computer Engineering in 2009 from Kadir Has University. From 2009 to 2011, he worked as a Graduate Assistant at Faculty of Engineering and Natural Sciences in a Kadir Has University. Since the beginning of 2011 he is project manager and ios developer in an Invemo Communication Systems and Information Technologies.