International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970)
Volume-4 Number-3 Issue-16 September-2014

Mobile Application Technology in Nigeria: A Case Study for Innovation & Transformation

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Abstract

Mobile applications are on the rise globally and Nigeria as one of the leading countries in Africa in internet and mobile phone consumption should not be left behind. Mobile phones are affordable and now come with a lot of processing power. Applications written on mobile devices can go a long way in solving some really serious problems. The objective of this paper, therefore is to showcase a mobile application in windows phone platform that loads locations of police stations close to the user through his/her GPS coordinate readings. It goes further to show the need of having Nigerians developing applications for Nigerians using tools like the Android ADT and the windows phone SDK. Agile development methodology was used in this sample as it supports increments which makes development circle flexible and allows developers to focus on a feature at a time depending on the size of the team. It was established that having locals develop applications for their communities in most cases, lead to development of applications that are really geared towards solving users' problems.

Keywords

Windows phone, GPS, Android, ADT and SDK

1. Introduction

The launch of Global System for Mobile (GSM) communications in 2001 has revolutionized how Nigerians communicate it not only showed Nigerians' readiness to accept technology but their readiness to spend their hard-earned money on technology that makes their life a lot easier. It is not strange to see a Nigerian with two or more phones trying to make sure he enjoys the benefit of all service providers and OEMs (Original Equipment Manufacturer) regardless of the cost.

The burst of the mobile technology in Nigeria has opened up new possibilities for services to be brought closer and faster to the users and these services to meet the ever growing consumer requirements and needs. It is no longer uncommon to see average user whip out a smart phone from his pocket and access a plethora of information consumed from big data systems. Mobile phones now have more processing power than the whole of NASA (National Aeronautics and Space Administration), OMG Facts [1], when it placed two astronauts on the moon. Modern mobile devices can process data at 1.2GHz which is faster than some early day desktop computers and laptops. What this actually means is that mobile devices now have the capacity to run applications that can help solve complex problems we encounter every day. There is a serious lack of service delivery in Nigeria not because of the lack of accessible mobile applications but mainly because of the lack of mobile application infrastructure tailored towards providing accessible and consumable services. With almost everyone owning a mobile phone, not only can we capitalize on this to give people faster information, but it also gives the possibility for us to also get feedback on what people are saying about particular services within a very short time frame. Imagine such processing power in the pockets of so many and the ability to make life better for these people at little or no cost!

According to Rupnik, Bajec and Krisper [2], the information society is enabled by technology, but it is far more than just a technology-driven society. In a study of over 34,000 people worldwide as reported by Singer [3] browser Opera found that in some countries almost half of new Internet users use mobile devices only. From the above statistics, it is evident that the mobile applications are increasingly becoming the major source of internet connectivity and source of information.

This work was supported in part by the Department of Computing, Faculty of Computing and Applied Sciences, Baze University, Abuja, Nigeria.

Manuscript received July 24, 2014.

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2. Literature Review

According to Iwhiwhu et al [4], GSM has greatly improved the socioeconomic, security and information based sectors of the economy. It is now a known fact that the world has left Nigeria behind on technology. Hacker [5] ranks Nigeria as the largest internet consuming country in Africa with a population of about 167,000,000 people, a mobile penetration of 69.01% and a 28% internet user base. It would be considered wise if we could capitalize on this medium to pass and obtain information faster.

In the opinion of Blueberry Consults Ltd [6], the "furious rate of technological change and growth in the mobile market has made it very challenging for developers to strategically plan a bespoke project, not only from a technical standpoint, but also because the market share for smartphones is changing rapidly between different systems."

Until recently, according to Kosaraju [7], the iPhone iOS has dominated the mobile market, but Google Android has now demonstrably overtaken iPhone in terms of market share, due partly to the power of the Google brand and partly to the platform's openness. Other mobile operating systems according to Kosaraju [7] include the Blackberry RIM OS and Windows 8.

The Federal Government of Nigeria, through the Ministry of Communications Technology and other departments and agencies of the government, according to Opara [11] "had also developed machineries and frameworks to drive this new area of growth and sustain its relevance and contributions to the economy. One of the known efforts of government was the creation of incubation centers for app developers across the country."

Kosaraju [7] has predicted that three horse race of IOS, Android and Windows mobile will dominate mobile market. He predicted further that Mobile application war will heat up further. But, Gartner [9] in a recent global report revealed that consumers are increasingly turning to recommendation engines, friends, social networking or advertising to discover mobile applications rather than sorting through the thousands of mobile apps available. Pyramid Research [8] and Opera [11] believed that this is a new consumer trend.

Dulaney as reported by Gartner [9] and Opera [11] describes the mobile application market as "hyperactive" with more than 200 vendors developing mobile application development platforms and millions of developers using these products and open-source tools to build mobile applications. This view was supported by Lynn 17]. Furthermore, Dulaney as reported in Gartner [9] stated that the bounty of good, free mobile apps has set high expectations for what should be paid for.

In today's world, according to Olofin [10] the speed of changes and emergence of novelties in the area of technology often overtake the science and development of methodologies to support changes. Mobile applications according to Olofin [10] are examples of such overtaking.

In the words of Rahul [12], a typical end-to-end mobile testing process, should start from creating test cases of the application, performing user acceptance and finally device testing stage.

3. Case Study: MobileCop

We have decided to design this application to help people who are in danger have a better chance of contacting the police to help them out or even help their neighbour out. In advanced countries, a single 911 call will do the trick but we don't have that in Nigeria, so the platform is mobile.

Input

The input of this application will be JavaScript Object Notation (JSON). JSON-LD[19] stated that JSON is a lightweight data-interchange format. Jonathan Vanderoost .Net Consultant [18] affirmed that JSON is easy for humans to read and write. Furthermore, Jonathan Vanderoost .Net Consultant [18] stated that JSON is easy for machines to parse and generate. Also, Jonathan Vanderoost .Net Consultant stated that JSON is based on a subset of the JavaScript Programming Language. JSON is language independent that uses conventions which programmers of Python, Perl, C#, C++, Java, and JavaScript are familiar with. According to Jonathan Vanderoost .Net Consultant [18], these properties make JSON an ideal data-interchange language. Due to its lightweight nature, affirms Code Mobile [13], JSON fits nicely for mobile application development because of its still little processing power compared to normal computers.

JSON takes on these forms:

An object and an array An object (figure 1) is an unordered set of name/value pairs. An object according to Code Mobile [12] begins with { (left brace) and ends with } (right brace). Each name in the words of Balkar [21] is followed by : (colon) and the name/value pairs are separated by , (comma).

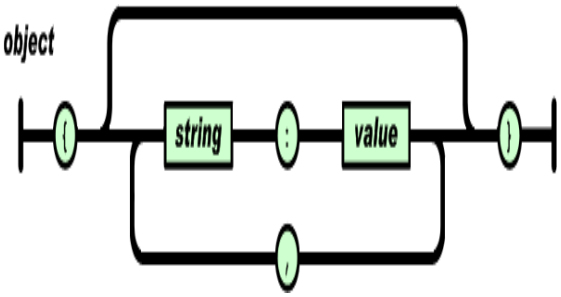

Figure 1: json object (source: json.org)

An array (figure 2) according to ECMA-404 The JSON Data Interchange Standard [20] is an ordered collection of values. According by ECMA-404 The JSON Data Interchange Standard [20], an array begins with [(left bracket) and ends with] (right bracket). Values are separated by , (comma) asserted ECMA-404 The JSON Data Interchange Standard [20]. An array according to ECMA-404 The JSON Data Interchange Standard [20] is an ordered collection of values. An array according to Code Mobile [12] begins with [(left bracket) and ends with] (right bracket). Values as stated also by Code Mobile [12] are separated by , (comma)

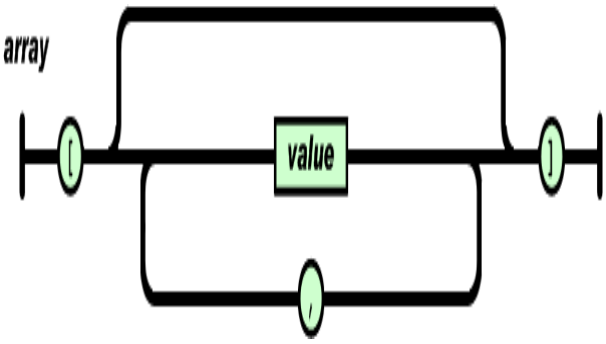

Figure 2 : json array (source: json.org)

Output

The output of our REST API is the JSON data we wish to consume and this comes in the following form:

{"location":[{"pid":"4","longitude":"8.8359202 210","latitude":"7.4974748750","description":"0812 9698896","created_at":"2014-02-11 3:52:43","updated_at":"0000-00-00 00:00:00","station_name":"Gwarimpa"},{"pid":"5","longitude":"5.6518000000","latitude":"10.3281000000","description":"08071477282","created_at":"2014-02-19 16:28:51","updated_at":"0000-00-00 00:00:00","station_name":"Kontagora"},{"pid":"6","longitude":"8.0303000000","latitude":"8.8549000000","description":"08026464732","created_at":"2014-02-19 16:28:51","updated_at":"0000-00-00 00:00:00","station_name":"Keffi"},{"pid":"7","longitude":"8.2336000000","latitude":"8.4313000000","description":"08071687282","created_at":"2014-02-19 16:31:05","updated_at":"0000-00-00 00:00:00","station_name":"Lafia"},{"pid":"8","longitude":"6.8548000000","latitude":"8.2085000000","description":"08026409732","created_at":"2014-02-1916:31:05","updated_at":"0000-00-00 00:00:00","station_name":"Kogi"},{"pid":"9","longitude":"6.0967000000","latitude":"9.0937000000","description":"08071324282","created_at":"2014-02-19 16:33:45","updated_at":"0000-00-00 00:00:00","station_name":"Kafanchan"},{"pid":"10","longitude":"7.9864000000","latitude":"9.4623000000","description":"08023835632","created_at":"2014-02-19 16:33:45","updated_at":"0000-00-00 00:00:00","station_name":"Bida"}],"success":1}

The final output of our data is the processed readable JSON data which we will use to attach our pushpins to Bing maps and eventually call the respective police station.

4. Methodology

Agile methodology is the choice methodology for this system since there is no telling how big it will grow and agile methodology supports incremental development. This means more features can come later without requiring any major system rebuild. The flowchart of Agile Methodology is presented in figure 3.

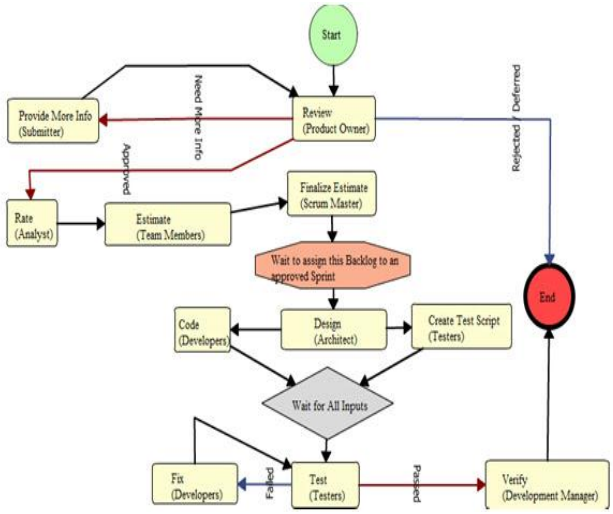

Figure 3: Flowchart of Agile methodology
(Source: http://www.kovair.com/images/agile-4.jpg)

Incremental development

This is a form of agile development where releases are referred to as "increments" (figure 4) with each increment providing more functionality to the customers. After the first increment, a core product which wraps the whole idea is delivered, which is ready to be used by the customer. Based on customer feedback or rise of better ways of solving this problem, a plan is developed for the next increments, and modifications are made accordingly. The system is not considered delivered until the increment process is complete.

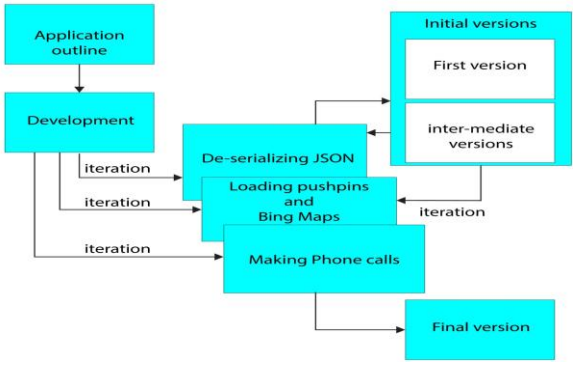

Figure 4: Flowchart of Incremental development of the application

5. Tools

The following tools were used in the development of the mobile application.

- Visual studio is the native development environment for developing windows phone applications.
- Windows phone SDK is the software development kit that allows us to package our applications for windows phone devices.
- REST API is meant to avoid a situation where the application has to be updated whenever we get new data, a REST API is used to supply JSON data to our application which doesn't require us recompiling every time.
- Bing Maps SDK is used because of compatibility, being also a Microsoft product.
- GPS (Global Positioning System) will be used to load current location
- NewtonSoft.Json.dll: This is a dynamic link library that helps us serialise and de-serialise JSON data, which is what we have to the JSON we get from the REST API.

6. Work flow

The work flows of the application are detailed thus:

1. First we have to download our JSON data to our mobile device.
2. The next step is to de-serialized data.
3. Load the bing maps of our current using GPS.
4. Populating our map with JSON data locations of police stations on the map from the one closest to us on the map.
5. Allow touching of pushpin to call respective police stations.
6. Implement a phone task to call the police station closest or the one he wishes to call.

7. Implementation

This is the stage where an executable file is created. In this case it is called a xap file. This stage involves converting requirements to high level language which is then compiled into machine language thus giving birth to the required xap file.

The application will have a single interface on a map and numerous pushpins to depict numerous police stations. Figure 5 shows the stages of navigating through the application.

The first thing we will need is the Bing maps API key which can be gotten from Microsoft [14] link, without this key we can't add our own features to the maps. After doing that we then have to reference Newtonsoft.json. This is the library that will help us process our JSON (figure 6).

To achieve this we have to consider the fact that internet and power are not on our side as Nigerians so we have to try our best to minimize how much we consume. The fact that we are not God means we are prone to mistakes so every key command has to be within a try block in case of any unhandled exception which we should be would catch in the catch block.

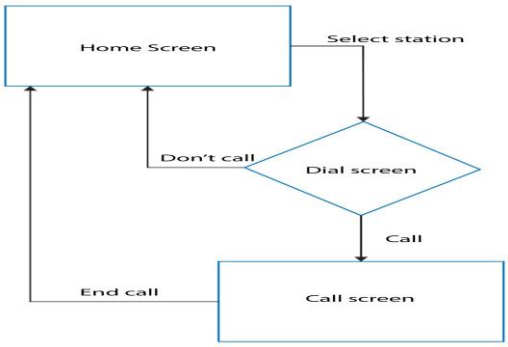

Figure 5: Flowchart of the application

As shown in figure 6, when the user launches the application to trigger the code in figure 7, he/she is welcomed by Bing Maps with different police stations already pinned on the map and the users' location is also displayed.

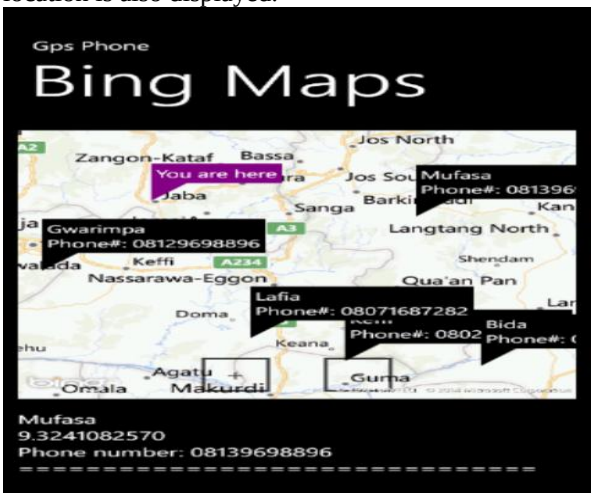

Figure 6: Image of the home screen with user location in purple and police stations in black.

```
public MainPage()
  {
      InitializeComponent();
      //Web client call to JSON API
     WebClient wClient = new WebClient(); Fori [15]

         wClient.DownloadStringCompleted +=new
DownloadStringCompletedEventHandler(wClient_D
ownloaded);
         wClient.DownloadStringAsync(new
Uri("http://localhost/Police/get_all_locs.php"));

      } Fori [15]
```

Figure 7: Sample code that makes the API call and loads the home screen

The user can now touch the police station pushpin closest to him to trigger the code as shown in figure 8 and load the page displayed in figure 9 to dial and report an emergency or crime.

Figure 8: Image of dial screen

```
void        stationPushpin_MouseLeftButtonUp(object
sender, MouseButtonEventArgs eve)
{
 try
{
phoneTask.DisplayName = "Lafia Station";
phoneTask.PhoneNumber = "####";
```

```
phoneTask.Show();
}
catch(Exception ev)
{  Jonathan [22]
MessageBox.Show("Try later "+ev); Karlrose [16]
}
}
```

Figure 9: the code responsible for making phone calls

When a user touches a pushpin he/she gets to the dial screen where they can proceed with the call or cancel the operation. If a user continues the operation, it will lead to the call screen in figures 10 and 11 where the user will have a one on one communication with the police station.

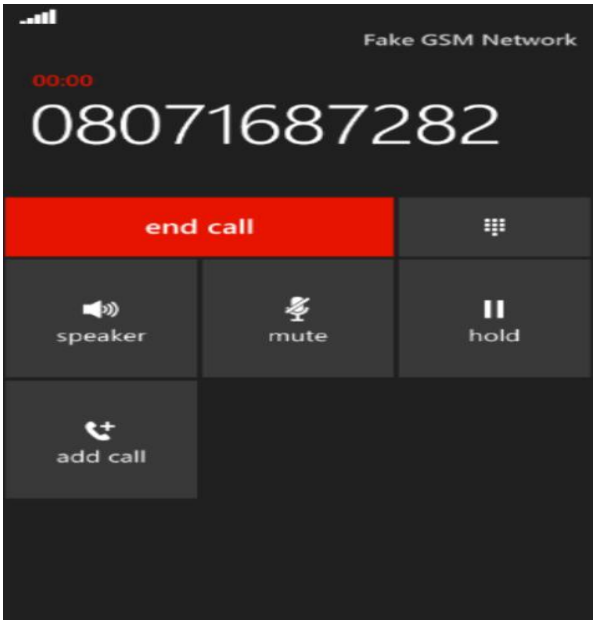

Figure 10: Image of the call screen

```
public void wClient_Downloaded(object sender,
DownloadStringCompletedEventArgs e)
    {
      try
      {
        var rootObj =
JsonConvert.DeserializeObject(e.Result);
        foreach(var stationz in rootObj.location)
        {   Castilla [23]
          dList.Items.Add(stationz.station_name);

          dList.Items.Add(stationz.longitude);
          dList.Items.Add(stationz.latitude);
        }  Castilla [23]
      }
      catch (Exception ex)
      {
        MessageBox.Show("Error>>>> "+ex);
      }
    }
```

Figure 11: code for de-alizing JSON

After the user is done with the call he ends the call and is taken back to the home where he can close the application.

The implementation stages are made straight forward as this application is built to make the user get fast communication to the police station before situations get out of hand.

8. Conclusion and Future Work

After testing this application and seeing the positive effects it can have on its mobile based platform, we suggest the development of different mobile platforms (Android, iPhone, Java, Symbian, Meego, Cosmos) to increase coverage in future.

A mobile application will enable the public feel close to security enforcement agencies and will increase intelligence supply of the agencies as people can now give them information without fear of exposing their identities. Imagine many applications like this that are tailored to tackle our own very problems in our own unique way. Nobody knows Nigeria's problem more than Nigerians.

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