# Towards A Mobile Drugs Authentication System For Nigerian Users

**Ukaoha, K. C.,  Dim, C. N., & Daodu, S. S.**
Dept. of Computer Science
University of Benin
Benin City, Nigeria

**Odikayor-Ogbomo, F. I.**
Dept. of Mathematics and Computer Science
Benson Idahosa University
Benin City, Nigeria.

*Corresponding E-mail:* *kingsley.ukaoha@uniben.edu*

## ABSTRACT

Mobile Application for Drug Authenticating is a system that ascertains the validity of drugs using a mobile smartphone. The National Agency for Food and Drug Administration and Control (NAFDAC) already has a Mobile Authentication Service (MAS) that enables consumers verify drugs with a mobile phone. The current system is faced with usability issues which the proposed system aims to improve on, by validating drugs with ease and a prompt to report invalid drugs. The system is implementable using techniques deployed in the existing system, and also new technologies presenting a more technically robust, user-friendly, cost-effective and portable system.  The proposed system requires 30 seconds or less, for a drug to be verified. During a query session the application makes an internet connection with users' data service and connects to the central database containing valid drug data. Though, not everyone can afford mobile phones compatible with this application or are able to use this application for drug authenticity, this poses a challenge for the time being. However, with the rapid drop in prices of smartphone especially those running on Android Operating System, Mobile Application for Drug Authenticating would also be accessible by the average Nigerian in the coming years.

**Keywords**: Drug verification, Counterfeit Drugs, Mobile Healthcare, Telemedicine.

## 1. INTRODUCTION

Pharmaceutical products which are produced and sold with the intent to deceptively represent its origin, authenticity or effectiveness are generally referred to as counterfeit medications (Wertheimer and Wang, 2012). This definition is in concert with the World Health Organization's (WHO) definition; Counterfeit (or fake) medicines are manufactured using incorrect or harmful ingredients. These medicines are then packaged and labeled to look like real brand-name and generic drugs. Counterfeit medicines are unsafe because they may lead to unexpected side effects, allergic reactions, worsening of medical conditions and even deaths.

Mobile application are sometimes categorized according to whether they are web-based or native apps, which are created specifically for a given platform. A third category, hybrid apps, combines elements of both native and Web apps (Wigmore, 2013).  A mobile application or "mobile app" is defined as a software application that can be executed (run) on a mobile platform (i.e., a handheld commercial off-the-shelf computing platform, with or without wireless connectivity), or a web-based software application that is tailored to a mobile platform but is executed on a server (Zeppa and Lewis, 2013).

The Mobile application for Authenticating Drugs in this work is called Drug Checker, a mobile-device-based hybrid application to verify the genuineness of drugs purchased by consumers against a database that must have been populated with valid drug data. Consumers are required to type a single-use alphanumeric character contained on the drug packaging to a designated server. A return message will indicate if the purchased drug is "genuine" or "fake". Drug Checker Mobile Authenticating application helps customers use mobile phones to check information about a drug in a user friendly interface at a response time of 30 seconds or less to confirm if it is a counterfeit or genuine drug.  The system is designed for use on Android-based phones or other smart phones and with their prices becoming more affordable, it is hoped that more people would be able to afford it soon thereby improving on the usability of the app.

## 2. BACKGROUND OF STUDY

Authorities have been plagued with detecting counterfeit drugs before they reach patients. Fake drugs are a major issue in Nigeria with thousands losing their lives every year to fake and adulterated drug in the country (Foreman, 2014). In 2007, the world's first free-to-access anti-counterfeit platform was established in the West African country of Ghana. The platform, dubbed mPedigree, relies on existing GSM networks in that country to provide pharmaceutical consumers and patients with the means to verify whether their purchased medicines are from the original source through a free two-way SMS message, provided the manufacturer of the relevant medication has subscribed to a special scheme (OurMed, 2015). Still in trial stages, the implementers of the platform announced in 2009 that they are in partnership with Ghana's Ministry of Health and the country's specialized agency responsible for drug safety, the Food and Drugs Board, to move the platform from pilot to full-deployment stage. A similar service is being rolled out in India due to the phenomenal growth in the country's pharmaceutical industry as well as the parallel counterfeit drug market (Chandu, 2011).

The National Agency for Food and Drug Administration and Control (NAFDAC) launched Mobile Authentication Service (MAS) that will enable consumers check whether a drug is original or fake with your mobile phone in 2010 using technology from Sproxil. Sproxil is a venture-backed, social enterprise that provides world-class brand protection services in emerging markets. Through the company's Mobile Product Authentication (MPA) solution, brand owners can connect with their customers in a way not previously achieved, by helping to ensure the goods they purchase are not stolen or counterfeit (Sproxil, 2015). The existing system is functional, quite basic, and straight forward, ensuring that users from every level can use it for the purpose it was built. The choice of SMS and USSD as the means of interaction with the system makes it available to mobile users' irrespective of their phone's capacity and data availability.

However, the current system was designed and deployed at a time that internet penetration was much lower than it is now and therefore opens vistas for richer mobile applications that can be and do more than SMS and USSD.  The proposed system employs the technologies that users have come to expect in modern applications, and facilitates better adoption and is limited to design and implementation of a Mobile App for Drug Authentication  running on Android Operating System (OS) so that it could be effectively handled within the given time and limited resources available.

## 3.  SYSTEM DESIGN

### 3.1 Proposed System

The existing system is functional, quite basic, and straight forward, ensuring that users from every level can use it for the purpose it was built. The choice of SMS and USSD as the means of interaction with the system makes it available to mobile users' irrespective of their phone's capacity and data availability. However, the current system was designed and deployed at a time that internet penetration was much lower than it is now and therefore opens vistas for richer mobile applications that can be and do more than SMS and USSD. The current system is also plagued with usability issues, as its use of SMS makes it clumsy, un-interactive and un-friendly for users of this time.

These pose a major challenge to the continued usage of the system and raise the need for a new and better one, one that employs the technologies that users have come to expect in modern apps, and facilitates better adoption. The proposed system will feature a centralized online MySQL database that is interfaced with a Content Management System (Wordpress) for easy drug-data management. Stored drug-data is further exposed in the JSON (Javascript Object Notation) format so that external applications like the mobile app can easily integrate the exposed data for use by mobile phone users.

Being a modern mobile app, the proposed system features a rich and intuitive user interface with labels, text-fields and buttons that make it easy for users to interact with the app. During a query session (when a user is trying to authenticate a drug), the app makes an internet connection with the user's data / internet subscription and connects to the central database containing valid drug data, it then compares the properties / particulars of the drug being validated with existing valid drugs to ascertain its authenticity. If a match is found, the user is presented with more details about the drug to aid its usage and consumption. However, if a match for a valid drug is not found, then the drug being checked is displayed as an invalid drug and the user is prompted to report the drug and place of purchase for action by organized authorities.

#### 3.1.1 Algorithm For Drug Checker

Step 1:   Start Drug Checker:  Click on Drug Checker app icon on your mobile phone.
Step 2:   Input Drug Name, Scratched PIN and NAFDAC Number.
Step 3:   Click on the "Verify This Drug Now" button.
Step 4:   If Scratched PIN is true and NAFDAC Number is true DO step 5 ELSE step 6.
Step 5:   Output Drug Details then DO step 10.
Step 6:   Output "This Drug Does Not Exist, Report this drug".
Step 7:   If Report is true, go to step 8 else go to step 10.
Step 8:   Input Report.
Step 9:   Click the "Send' button.
Step 10: Exit Drug Checker.

### 3.2 Hybrid Mobile Application Development

Hybrid mobile application development relies on HTML5 technologies in application development and coding, such that any device running a modern web browser can be made to run the app after it has been packaged for the platform of that mobile phone. Drug Checker Mobile Authenticating application was coded and debugged in Java programming language, the compilation process created an HTML5 application that was then packaged for Android devices, and can also be packaged for Windows phone and iOS devices.
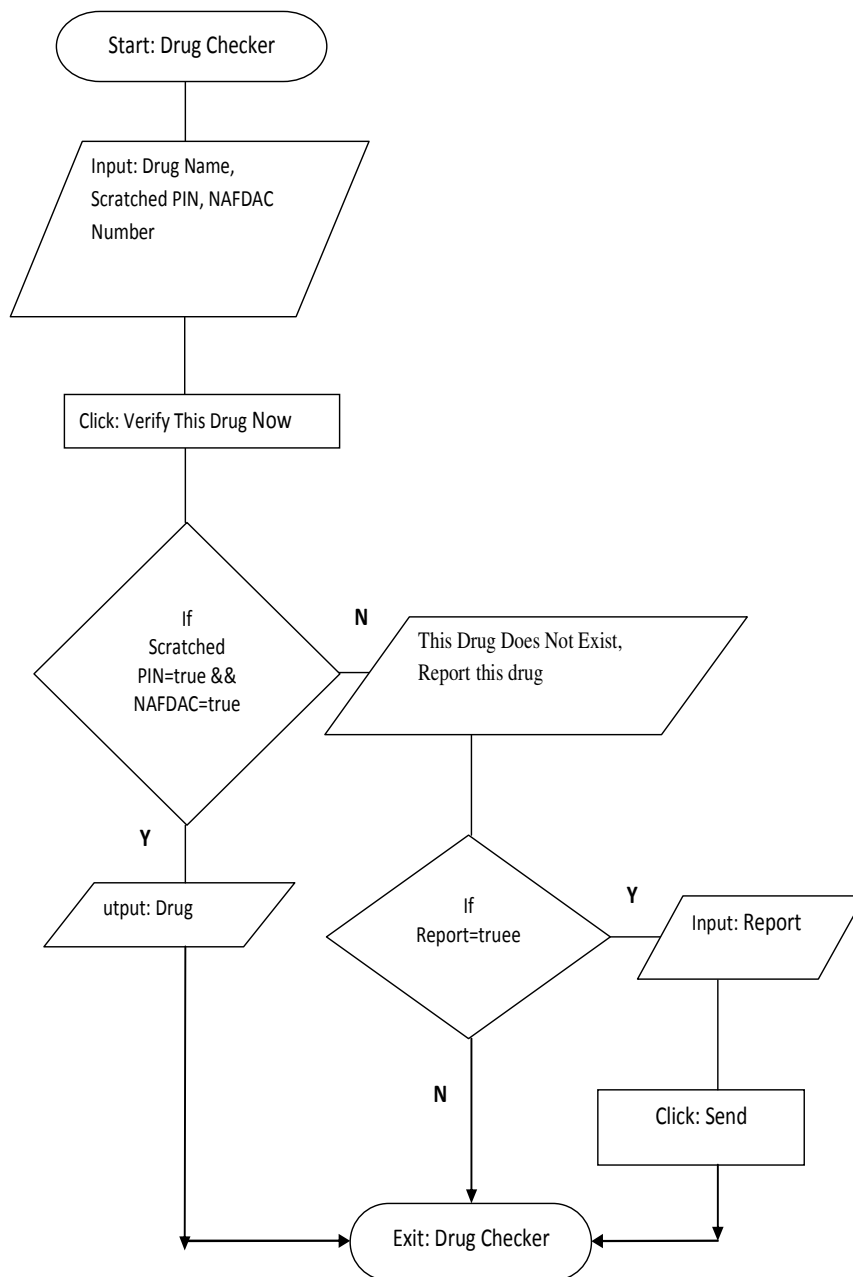


**Figure 3.2: Flowchart for Drug Checker**

### 3.3 System Design

A collection of properly installed software and configured tools to aid in the development of the mobile application is required and they include:

### 3.3.1 Java 7 SDK
Java 7 SDK (Software Development Kit) provides the necessary low level tools for compiling Java source code and also executing it.

### 3.3.2 Eclipse Ide
Eclipse IDE (Integrated Development Environment) is a tool that is used to effectively code and develop applications. It has Java code formatting and syntax highlighting, as well as code completion and instant error checking and debugging.

### 3.3.3 Maven 3
Maven is a build and dependency management tool for Java projects to define and manage the dependencies for a project and to easily execute standard during the development of a Java application.

### 3.4  Software Frameworks Needed To Develop The Mobile App
### 3.4.1 Google Web Toolkit (Gwt)
Code written and debugged in Java is translated to HTML / Javascript by the GWT compiler such that it is ready to be executed by any HTML5 engine e.g. a web browser.

### 3.4.2  ERRAI Framework
With Errai, HTML5 applications can now easily integrate with mobile hardware through PhoneGap.

### 3.4.3  Apache Cordova / Phonegap
The Cordova / PhoneGap tool is the most important asset in the arsenal of a Hybrid mobile application developer.  It takes the Java code written in the Eclipse IDE and coupled by Maven and GWT / Errai into HTML5 / Javascript code, and then packages it into a mobile application for a target platform like Android or Windows, or iOS, making the app downloadable either via a link or QR code (Quick Response Code).

## 4.  IMPLEMENTATION AND RESULT

The proposed system is implemented as a modern mobile application that can be installed on a mobile phone and features interactive User Interface elements, better visual cues, a much responsive and faster system, and therefore a delight to users. The proposed system will feature a centralized online MySQL database that is interfaced with a Content Management System (Wordpress) for easy drug-data management. Stored drug-data is further exposed in the JSON (Javascript Object Notation) format so that external applications like the mobile app can easily integrate the exposed data for use by mobile phone users.

Being a modern mobile app, the proposed system features a rich and intuitive user interface with labels, text-fields and buttons that make it easy for users to interact with the app. When a user trys to authenticate a drug, the app makes an internet connection with the user's data / internet subscription and connects to the central database containing valid drug data, it then compares the details of the drug being validated with existing valid drugs record to confirm its authenticity. If a match is found, the user is presented with more details about the drug to aid its usage and consumption. However, if a match for a valid drug is not found, then the drug being checked is displayed as an invalid drug and the user is prompted to report the drug and place of purchase for action by organized authorities.

**4.1 How To Use Drug Checker After Installation**

Step 1:   In the user's mobile phone, locate the Drug Checker app, click on the app like you would in every other app.

Step 2:   An intuitive user interface would be displayed which is the home screen. User is to input drug name, unique code, and NAFDAC number in the text field (See Figure 4.1). Then click on the "Verify This Drug Now" button for verification of the purchased drug.



**Figure 4.1:   User Interface for Home Page (Using Lonart as an Illustration)**

Step 3:  If the drug is genuine, a drug detail screen would be displayed (see Figure 4.2). The user can click on the "OK! Back To Home" button to navigate back to home screen should the user want to verify another drug or user can exit app by clicking the back button on user mobile phone, if there are no other drug to be verified. If the drug is not genuine, a drug detail screen would be displayed with no information on MFD, EXD, Produced By, and the Description of the drug would be "This Drug Does Not Exist" "Kindly report to the authorities right away, Tap the button below" (see Figure 4.3). The user is advised to click on the "Report This Drug" button which would display a "Report Drug" interface to report the invalid purchased drug. When all required text field have been satisfied, then a click on the "Send Report" button will send the information given by the customer to a dedicated email address for the fight against counterfeiting of drugs.



**Figure 4.2: Screenshot for Valid Drug Detail**



**Figure 4.3: Screenshot for Invalid Drug Detail**

## 5. CONCLUSION

The Drug Checker described above is a valuable tool in protecting patients from taking counterfeit and substandard quality medicines using a mobile phone (Smartphone). It can be used to transform health protection. Substantial benefits can be achieved through the use of Drug Checker.

Over the past decades, there has been a rapid advancement in Mobile phone based on smartphone technology with a great fall in prices especially the android mobile phones. The mobile phone industry is stabilizing to a smaller number of core operating system platforms examples include Android, Windows, iOS. Mobile phones are ubiquitous and extremely common in most of the susceptible areas. Leading to a great possibility of the widespread use of mobile app for drug authenticating in Nigeria in years to come, as the future of mobile phone on a global scale is promising for both consumers and pharmaceutical industries.

## REFERENCES

1. Chandu, G. (2011), "Detect Counterfeit Drugs Through Cloud Services Technology, System Evolved from HP's Pilot African Project". Retrieved from <http://articles.economictimes.indiatimes.com/2011-09-29/news/30218200_1_counterfeit-drugs- life-saving-drugs-fake-medicines> 16th May, 2015
2. Foreman J. 2014, "Raman Spectroscopy used in the Identification of Counterfeit Pharmaceuticall" Retrieved from <http://www.centice.com/wpcontent/uploads/ CounterfeitPharmaceuticalsandRamanSpectroscopy.pdf>, 15th January, 2015
3. OurMed (2015), "Counterfeit Medications". Retrieved from ourmed.org/wiki/Counterfeit_medications>
4. Sproxil, (2015), "Drug Anti-Counterfeiting Technology Reaches 1 Million Uses". Retrieved from < http://www.sproxil.com/blog/drug-anti-counterfeiting-technology-reaches-1-million-uses/>
5. Wertheimer A.I and Wang P.G. (2012), "Counterfeit Medicines; Policy, Economics and Countermeasures". Retrieved from <http://arxiv.org/ftp/arxiv/papers/1211/1211.1242.pdf>, 17th December, 2014, Pg 3-8
6. Zeppa S. and Lewis L. (2013), "The FDA Releases Long-Awaited Final Guidance on Mobile Medical Applications", Retrieved from < http://www.sheppardhealthlaw.com/2013/09/articles/other/the-fda-releases-long-awaited-final-guidance-on-mobile-medical-applicatio ns/>, 17th December, 2014