

## Implementation of an Enhanced Food and Drug Authentication System in Nigeria

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### ABSTRACT

Food and drug counterfeiting have become an economic and social problem for decades since they affect human beings directly due to the unavoidable importance of food and drug to live. Food and drug counterfeiting are part of the causes of mortality and loss of public confidence in medicines and health Institution. The purpose of this research is to build an enhanced web based technology system that will profile all packed food and drug in Nigeria for authentication, to ensure that they are safe for consumption, provide database system that profile pharmaceutical companies and packaged food producers in Nigeria as well as tracking activities of counterfeiters to reduce circulation of fake products. Object Oriented Analysis and Design Methodology (OOADM) was adopted. Where HTML 5, AJAX, PHP5, JavaScript, CSS and MySQL were employed for the design of the front and back end of the system. With this system, all consumable drugs as well as packaged food will be verified before consumption to ascertain their authenticity and enable the Government Agency in charge to monitor the activities of Pharmaceuticals and packaged food manufacturers in order to track counterfeiters. The research has shown that safety of drugs and packaged food can be ascertained and also activities of counterfeiters can be monitored in Nigeria.

Keyword: Hologram, Security rings, Security threads, Mobile Authentication Service (MAS)

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### INTRODUCTION

Drug Faking is a global public health problem, because the effects can be felt from both the country of manufacture to the recipient countries. Hence, national measures for combating of fake drugs in a country might be insufficient because of the advanced sophistications of those who manufacture and sell them [1].

Counterfeit drugs are drugs that are not authentic and have been manufactured using incorrect quantities, or incorrect ingredients, to either reduce the potency, or nullify the potency of drugs altogether, and the same is applicable to food counterfeit. Addition of harmful ingredients could also lead to counterfeiting, and may cause serious health effects amongst the patient population. As counterfeiters have started working cross borders, the counterfeited drugs have become difficult to identify,

and have become a public health risk for people living across communities and borders [2].

The deadly implications of counterfeit drugs are understood to be a central challenge to the integrity of public health systems around the globe, as well as a direct threat to individual health and welfare [3]. Nigeria is not an exception in the problems of fake drugs because some people still prefer self-medication when they are ill, and often the drugs are bought from unlicensed drug vendors, whose drug quality is not sure.

These high incidents of counterfeit medicines across the globe have ushered in recent years, the era of anti-counterfeiting, which dovetail to the fight against the menace. The fight is gaining global momentum and a flurry of activities and strategies are being

engaged by anti-counterfeiting regulatory agencies towards curbing the menace. Nigeria is not left out in this move, and has established a regulatory agency - the National Agency for Food and Drug Administration and Control (NAFDAC), which has been in the vanguard of the fight. NAFDAC was established by the Federal Government of Nigeria in 1993 with the mandate of safeguarding the health of the nation through the provision of effective regulation of the food, drug and chemical sector of the economy. One of the objectives of the agency was to make available at all times to the Nigerian populace, adequate supplies of drugs that are effective, affordable, safe and of good quality. The high prevalence of counterfeit medicines particularly anti-malaria medicines, antibiotics, and vitamins in Sub-Saharan Africa generally and particularly in Nigeria, necessitated this decision. Counterfeit or fake food usually means substituting a cheaper food for what a food item is claimed or labeled to be. For example, selling of palm kernel oil under the label of pure groundnut oil.

Food and drug counterfeiting have become an economic and social problem for decades since they affect human beings directly due to the unavoidable importance of food and drug to life. The World Health Organization (WHO) has discovered a terrific growth rate in food and drug faking especially in the developing nations which has caused alarming rate of ill-health and eventually deaths amongst all level of human development. Most countries have developed strategies to fight the growth of food and drug counterfeiting. Recently, the SMS verification method was confirmed efficient in some developing countries, but it was not implemented on all drugs. Moreover, food counterfeit is almost neglected in the fight against counterfeit, thereby posing greater threat to the societies [4].

Over the years, the agency has engaged different strategies in an attempt to combat the menace of counterfeiting. According to NAFDAC News (2013, p. 11),

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“in the past, a common strategy adopted by NAFDAC was the use of NAFDAC Registration Number on packages to be able to detect fake drugs.” However, as earlier observed, growing access and sophistication in printing technology now enables counterfeiters to manufacture fake drugs affixed with fake NAFDAC Registration Number. As a result, cloning of fast moving drugs is so perfect that even the brand owners find it difficult to differentiate between fake and original. It is against this backdrop and the drive towards achieving the then President’s target of Zero Tolerance to counterfeit, fake, sub-standard, spurious, adulterated and expired medicines in the country that the agency has resorted to the fight against counterfeiting of medicines through the adoption of cutting edge technologies, the objective being to rid the country of the “activities of counterfeiters who are merchants of death, trying to benefit at the expense of the health of others” (NAFDAC News, 2013, p. 4).

Some of the anti-counterfeiting cutting-edge technologies engaged by the agency include: Truscan, Black Eye and Radio Frequency Identification (RFID) and serialization. The Truscan is a hand held device for carrying out on-the-spot detection of counterfeit medicines; The Black Eye is an infra red technology used for speedy evaluation and detection of counterfeit medicines; The Radio Frequency Identification (RFID) helps in authenticating sensitive documents, while serialization is the process of identifying a medicine with a unique code printed onto the medicines pack and verification is the process for identifying and checking that code.

Considering some challenges faced by NAFDAC in the use of the above stated technologies to fight counterfeits, the agency therefore developed and launched Mobile Authentication Service (MAS) that empowers consumers in detecting counterfeit medicines. Using this technology, consumers can send a direct message (the assigned 12 digit NAFDAC PIN on the product they are about to buy)

[www.idosr.org](http://www.idosr.org)

to 38353, and receive an instant reply, telling you whether the drug is fake or original. Stressing the value and mode of operation of the MAS, NAFDAC News (2013, p. 20) observes that “the agency has deployed the use of SMS text messaging technology to authenticate medicines at the point of purchase, putting the power of detection of counterfeits in the hands of Nigerian consumers, thereby enlisting the entire Nigerian public in the war against counterfeiting.” One might be forced to ask, ‘Is the NAFDAC registration number and Mobile Authentication System (MAS) not enough to checkmate the rate of counterfeiting of drugs?

Well, Considering the recent challenges encountered by NAFDAC on full implementation of MAS(Mobile Authentication system), in the fight against Counterfeit drugs, the agency, said through the president (Prof. Moji Adeyeye) that the manpower and finance needed to implement the mobile authentication scheme was lacking at the moment, Daily Post News [5] and moreover, there was no appropriate System to checkmate packaged food.

The NAFDAC registration number was just to ascertain the legality of a manufacturing firm and not the product because the firm’s name and trademark can be stolen and cloned. More so, the Mobile Authentication System does not show the manufacturing/expiring date and some other details that could be used to verify or ensure the authenticity of the product.

This proposed unique code, will be able to ensure that once a product number is verified, the buyer will see manufacturing and expiring date, the content of drugs/food, the manufacturer, batch and serial number as well as the authenticity of the product. With this system, counterfeit drugs and packaged food will be well checkmate in Nigeria.

This system is designed to be a centralized authenticating system with a distributed database to authenticate food and drugs in the country. Every food and drug will be registered and given a unique

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code at the point of registration and there will be periodic screening of every manufacturing or production of the Pharmaceutical or Food Company. This code is not the NAFDAC registration as usual but every product will be given a code accordingly via its batch of production.

The present web based authenticating system recently launched by NAFDAC is still insufficient to fight product counterfeit due to the fact that not all drugs have been verified and given a unique code, also packaged food are still without this seal code, the web based authentication system is still based on NAFDAC registration number.

The proposed unique code cannot be cloned because it will remain invisible until the buyer of the product unveils the code. The National Agency for Food and Drugs Administration and Control (NAFDAC) have a system of certifying the safety of food and drugs before the producing company or a pharmaceutical starts production but no measure are in place for continual certification of the safety of those products initially certified safe. This resulted to the increase of fake food and counterfeit drugs.

#### **Background of the Study**

##### **The Effects of Falsified and Substandard Drugs**

The problems of Fake drugs have embarrassed our healthcare providers and denied the confidence of the public on the nation’s healthcare delivery system. The result of fake drug proliferation has led to treatment failures, organ dysfunction or damage, worsening of chronic disease conditions and the death of many Nigerians. The situation became so bad that even when patients were treated with genuine drugs, there was no response due to resistance caused by previous intake of fake drugs. [6]

A reliable, good-quality medicine supply is essential for health, but it is often missing in countries with weak regulatory systems [7]. The fallout of falsified and substandard medicines includes poisoning, untreated disease, early death, and treatment failure.

### **Poisoning**

Some of the most compelling stories of pharmaceutical fraud are those of frank poisoning. Between November 2008 and February 2009, 84 Nigerian children died from acute kidney failure brought on by the industrial solvent diethylene glycol in teething syrup [8]; [9] The contaminated product, My Pikin, was registered with the Nigerian regulatory authority and made in Lagos, the national manufacturing hub [10]. Inspectors traced the problem back to deliberate fraud by a chemical dealer in Lagos, eventually leading to 12 prosecutions [11]; [12].

A similar tragedy unfolded on a larger scale the previous year in Panama when a Chinese chemical manufacturer sold diethylene glycol, the active ingredient in antifreeze, as pharmaceutical-grade glycerin to a European company [13]. The poison caused acute kidney failure in the people who ingested it, often as the solvent in cough syrup [14]; [15]. The Panamanian government counted 219 deaths from kidney failure brought on by diethylene glycol poisoning [16]. Given that more than 60,000 bottles of cough syrup and some lotions were contaminated, the Ministry of Health and the World Health Organization (WHO) assume that these confirmed deaths are probably only a fraction of the total mortality [17].

The 2006 diethylene glycol poisoning was an international tragedy, and 18 of the casualties were Chinese [18]. In the early 2000s some sources called China “the world's largest producer of bogus medicines”; Chinese newspaper accounts contain stories of similar mass poisonings [19]. In 2001 reporters described the death of a southwest China mine owner from a poisoned albumin drip [20]. A decade later, the Chinese State Food and Drug Administration (SFDA) found that 13 percent of capsule manufacturers are making drugs containing unsafe levels of chromium, a toxic metal [21]. The SFDA identified 254 separate companies as sources of the chromium-tainted medicines [22].

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Though poisonous drugs are part of the story, the more insidious problem is medicine that simply does not work. Ineffective medicines often contain benign ingredients, such as chalk, pollen, or flour, instead of medicinal chemicals. More dangerously, some contain substances intended to mask the illness and feign treatment, such as paracetamol added to fake antimalarials to lower fever. Patients taking ineffective drugs die of apparently natural causes, making these products more difficult to identify.

### **Untreated Disease, Disease Progression, and Death**

Medicine is intended to cure patients, or at least to relieve symptoms or slow the progression of a disease. There is also useful information in treatment failure. When prescribing medicines of known content and potency, the clinician may suspect inadequate dosing, drug resistance, or misdiagnosis if the patient does not respond to treatment as expected. These inferences are central to the practice of medicine. The Partnership for Safe Medicines, an American nonprofit, encourages doctors to suspect counterfeit drugs in cases of treatment failure (PSM, n.d.), but there is little published evidence to suggest they do so. Advising physicians to consider the possibility of medicine fraud suggests that they have a way to verify it. In parts of the world where such assays are too costly or too technologically complicated to pursue, this information is usually unknowable. Confirmed accounts of drug failure are only a fraction of the larger, mostly invisible, problem.

Research at the medicine store can help illuminate these problems. A random sample of all known medicine shops in three districts of Ghana found the uterotonic drugs oxytocin and ergometrine to be of uniformly poor quality: 89 percent of the samples tested were below British Pharmacopoeia specifications though only 2 percent were expired [23]. Unicef, the United Nations Children's Fund, estimates the maternal mortality ratio in Ghana to be 350 per 100,000 live births [24], of which

hemorrhage, a condition treated with uterotonic drugs, is the most common cause [25]. Even in Ghanaian hospital studies, where one would expect hemorrhage to be an uncommon cause of death, it accounts for an estimated 17 to 22 percent of maternal deaths [26]; [20]. Increasing access to emergency obstetric care is a key piece of any strategy to reduce maternal mortality [3], one that lies on the assumption that lifesaving uterotonic medicines are of reliable potency. Research suggests they are not, even in a middle-income country like Ghana.

### **Treatment Failure**

Individual patients have much to lose from substandard and falsified medicines. These products also encourage drug resistance and thereby threaten population health today and for future generations. This is a particular concern with substandard products where the dose of active ingredient is low and variable and with falsified products diluted by criminals in an effort to pass screening assays. Drug resistance is common in pathogens with short life cycles: viruses, bacteria, and protozoa. Poor-quality antimicrobial medications, taken frequently and, in poor countries, generally taken without professional supervision, contribute to drug resistance.

### **Factors that encourage counterfeiting of product in Nigeria**

Some of the factors encouraging counterfeiting of products in Nigeria includes:

**Corruption:** According to the World Health Organisation (1999, p. 16) “the efficiency of personnel is adversely affected by corruption and conflict of interests resulting in laws not being enforced and criminals not being arrested, prosecuted and convicted for crime.” This situation smacks of corruption and has been the case with counterfeiting of medicines in Nigeria.

**Economic factors:** The adverse economic situation in the country has given impetus to the high incidence of counterfeiting. It has been observed that counterfeit drugs

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are usually cheaper and low priced compared to genuine ones. As a result, they are preferred and heavily patronized at the expense of the genuine drugs. A study by [6] in Ibadan, a city in South West Nigeria, showed that high cost of drugs and related health services were responsible for seeking alternative options like itinerant drug sellers.

**Poor health seeking behaviour:** [3] found that the health seeking behaviour of an average Nigerian is poor. Earlier, [12] observed that self-medication is usually the first step taken immediately the symptom of an illness is expressed or recognised. Self-medication, as [15] further observes, “Includes purchase of drugs, collection of herbs and preparation of concoction that is equally applied” This attitude, to say the least, encourages counterfeiting.

**Chaotic drug distribution system:** Drug distribution in Nigeria has been said to be very chaotic with drugs marketed like any other commodity of trade. It has also been observed that due to poor regulation over the years, drug markets have evolved and got deeply established all over the country despite the illegality of such activities. As a result, almost all drug manufacturers and importers supply to these drug markets. Drug sellers and even health professionals have been acknowledged to patronize the drug markets, which also service the hawkers that sell in streets and commercial buses [8]. NAFDAC has recently, however come up with a policy document – the National Drug Distribution Guidelines in attempt to address this systemic problem and ensure drug quality and safety.

**Sophistication in clandestine drug manufacture:** According to NAFDAC News (2013), drug counterfeiters have taken advantage of the growing access and sophistication in printing technology and now manufacture fake drugs affixed with fake NAFDAC registration number.

“This is why cloning of fast moving drugs is so perfect that even the brand owners find it difficult to differentiate between fake and original” [15].



**Lack of/inadequate legislation:** Nigeria is said to have a multiplicity of drug control laws that are unwieldy, overlapping and sometimes conflicting. Some of the laws are said to be so old and would need to be amended or updated to meet the demands of present day realities for effective regulation. This perhaps explains the rationale behind the revised NAFDAC Law, “presently receiving attention of the Federal Executive Council” which tilts essentially towards greater use of criminal enforcement (NAFDAC News, 2013, p. 20).

According to [8], the problem of laxity of ineffective judicial system and widespread corruption are major reasons why it is easy to produce and sell fake drugs. It enables fake drug producers to sell their products cheaply to chemists who in turn sell to the consumers. The ultimate loser are the consumers and the doctors who are treating, as patients would not get relieved or cured and the doctor's reputation would be damaged as a result, giving bad image to the health system. Access to essential medicines by the population irrespective of their income status is very important for healthcare delivery services to succeed. Prices people pay for medicines are very high, making access to medicine very difficult [11]. The chaotic drug distribution network and many unauthorized outlets, help in fake drug circulation. There is poor accountability to the disposal of medicine, which complicates the work of drug regulatory agency, NAFDAC [23]. The high incidence of fake drugs in Nigeria is a fallout from the haphazard ways import license on drugs were issued to anyone, by then politicians and military leaders in the 80's, disregarding the eventual public health implications of their actions. Some of the beneficiaries of the import license found out that a lot of money could be made from the drug business, and suddenly became emergency drug importers. With the booming market and competition, some of them looked at the option of importing fake products in

order to have an edge over their competitors.

In Nigeria today, it is common knowledge that drugs are treated as general merchandise, which can be obtained easily from open markets, moving vehicles, faceless medicine stores, ferries, and even in the provision stores. This is because the drug distribution business has been left in the hands of non-professionals who just want to make profit at the expense of the consuming public. Poor people are faced with a confusing myriad of health providers and drug sellers (NAFDAC Consumer Safety Bulletin, 2006). The problem of fake drugs was so severe that neighboring countries such as Ghana and Sierra Leone officially banned the sale of drugs made in Nigeria. The issue of fake drugs did not just stop there, but it went to the extent that drugs were hawked even in commercial buses. All these problems affected Nigeria as a whole.

government agency responsible for regulating and controlling the manufacture, importation, exportation, advertisement, distribution, sale and use of food, drugs, cosmetics, medical devices, chemicals and prepackaged water. Its creation was inspired by a 1988 World Health Assembly resolution requesting countries' help in combating the global health threat posed by counterfeit pharmaceuticals, and amidst growing concerns about the growing problem of fake and poorly regulated drugs in Nigeria. In December 1992, NAFDAC's first governing council was formed. In January 1993, supporting legislation was approved as legislative Decree No. 15 of 1993, and January 1, 1994 NAFDAC was officially established, as a “parastatal of the Federal Ministry of Health”. NAFDAC replaced an earlier Federal Ministry of Health body, the Directorate of Food and Drug Administration and Control, which had been deemed ineffective, largely due to a lack of laws concerning fake drugs and political issues. (NAFDAC 2005)

The objective of any drug regulatory agency is the protection and promotion of

public health. The enforcement directorate arm of NAFDAC established under the provisions of the counterfeit and fake drugs (miscellaneous provision) act is charged with the responsibility of enforcing the provisions of the counterfeit and fake drug decree, which includes:

- Conducting surveillance on companies and persons suspected to be violating NAFDAC regulations and carrying out investigations on such persons and companies.
- Paying unscheduled visits to all ports of entry and border posts and interrogation of suspects
- Sampling of NAFDAC regulated products to the laboratory and compilation of case files
- Raiding of drug hawkers and destruction of fake and spurious regulated products
- Coordination of activities of state task force.

The establishment of the task force in Nigeria was seen as a welcomed development for the fight against fake drugs.

However, with the inception of the “new NAFDAC” in April 2001, some achievements were reached causing a reduction of the problems (NAFDAC consumer bulletin, 2003). NAFDAC, in 2007 seized 82 truck-loads of fake, banned and expired drugs and closed five fake drug warehouses at the well-known Onitsha drug market, which according to a World Health Organization survey, has a 30 percent fake drug prevalence as against 10 percent in other parts of the country (Nigerian Tribune, 2007). The seizure of these products led to a more professionalized production and packaging of fake and substandard drugs in order to avoid detection. Thus, NAFDAC establishes and implements different strategies towards detecting these fake and substandard drugs. Some of the fake drugs detecting technologies introduced by NAFDAC include: Truscan, Mobile Authentication Service (MAS) using

Short Message Service (SMS), Black eye, and Radio Frequency Identification (RFID). Findings from previous studies indicate that these technologies are being deployed to a large extent in the fight against counterfeit medicines in Nigeria. Furthermore, the impact of these technologies on the control and regulation of counterfeiting in the country is reported to be positive and massive as recent studies have shown progressive reduction of counterfeit medicines. The recent study on the Quality of Anti-Malaria Medicines in Sub-Saharan Africa (QAMSA) which showed significant decline in the incidence of the counterfeiting of anti-malaria drugs in Nigeria from 64.9 percent in 2008 to 20 percent in 2012 is a watershed case of success (NAFDAC Survey, 2012). The strong correlation between the Agency's 2012 National Survey on Quality of Medicines using Truscan device and laboratory analysis which put the failure rate of anti-malaria drugs in Nigeria currently at 19.6 percent is again a significant milestone on NAFDAC's path of winning the war against counterfeiting. Holistically, evidence shows that the incidence of counterfeiting has significantly been reduced by the agency via deployment of the anti-counterfeiting technologies. Results from the National Survey on Quality of Medicines across the 36 states of Nigeria and the Federal Capital Territory (FCT) by NAFDAC between January 2010 and April 2012 using Truscan, for instance, showed that the incidence of counterfeiting has been reduced to 6.4 percent. The foregoing results by all standards clearly attest to the remarkable successes NAFDAC has achieved in the fight against counterfeiting through the adoption of anti-counterfeiting cutting-edge technologies.

#### **Related Concepts**

##### **Mobile Authentication Service**

The Mobile Authentication Service (MAS) works with mobile phones that are SMS enable. It allows individuals with mobile phones to check whether a drug is fake or original without direct contact with the

[www.idosr.org](http://www.idosr.org)

manufacturer. This service was introduced into Nigeria by National Agency for Food and Drug Administration and Control (NAFDAC) in response to the increasing rate of fake drugs sold in this country. It is an attempt to turn mobile phones into mobile tools that can help check this problem as many lives have been claimed and many are still endangered by the circulation of such fake products.

The National Agency for Food and Drug Administration and Control (NAFDAC) on February 2, 2010, launched the NAFDAC Mobile Authentication Service (MAS) with the aim of putting the power of checking for originality of product in the hands of consumer. The National Agency for food and Drug Administration and Control (NAFDAC) has made compulsory the implementation of MAS by all Pharmaceutical companies for all their major products especially the Antibiotics and the Anti-malarial drugs.

GlaxoSmithKline in partnership with National Agency for Food and Drug Administration and Control (NAFDAC) in February 2011, run a six months pilot anti-counterfeiting programme in Nigeria. In all a total of 145,000 texts from 115,000 unique users was received. This figure represents approximately 10% of use from the total products send out for the pilot programme. Ninety percent of text returned a genuine confirmation, 2.5% received a counterfeit alert and other received a message indicating a duplicate PIN

([www.developingcountriesunit.gsk.com](http://www.developingcountriesunit.gsk.com)).

The restructuring of NADFAC by the Oluseun Obasanjo's (Former Nigerian President) administration (in August, 2000 when the previous board was dissolved and creation of a new board headed by Prof Mrs Dora Akunyili (Late) as new Director General in April, 2001) brought a landmark achievement in the Nigerian as lot of foods and drugs were destroyed across the country notably the Onitsha drug market. Many other achievements have been recorded by NAFDAC since inception till date.

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In order to be abreast in its mandate and be the health frontier, NAFDAC maintains very close contacts with local and international bodies. These include different Nigerian food and drugs association like Pharmaceutical Society of Nigeria and United Nation International Drug Control Programme. (<http://www.nafdac.gov.ng/about-nafdac/nafdac-act>, Accessed on 04/10/2017)

### **NAFDAC Activities and Interventions in Control of Fake Drugs within the Legal Market:**

The activities of the "new NAFDAC" that was incepted in April 2001 will be discussed to see how interventions are carried out in controlling fake drugs within the legal, regulated market in Nigeria as well as some achievements that brought reduction to the problems and the areas that still needs amendment. This will be compared with other countries drug regulating Agencies. NAFDAC offices are located in the six geopolitical zones and in the 36 states of Nigeria with the national headquarter located at Abuja federal capital territory.

### **Inspection Processes as a Check to Drug Faking**

NAFDAC Nigeria has two directorates involved in inspection activities. They are the ports Inspectorate directorate (PID) in charge of imported products and the Establishment Inspectorate Directorate (EID) charged with locally manufactured products. The principle behind GMP inspection is that quality is built into the product and not just tested for in the finished product. It is also seen as a vital component for control of pharmaceuticals.

For GMP and routine inspection, NAFDAC adopts the WHO guidelines for inspection visits but does not carry out routine inspections abroad mostly due to financial constraints. Manufacturing companies abroad are inspected once during product registration. These could make manufacturers not to adhere completely to the specified standards. However, for local products, inspectors'



carryout unscheduled routine visits to factories.

The Ghana Food and Drug Board now carries out constant routine inspection of both imported and local facilities for drug regulation, this will gives them a better contact and monitor of activities of drug manufacturers [17].

**Drug distribution channels** in Nigeria are difficult to inspect. This is because it is chaotic and unlicensed, owned by illiterate traders whose interests are profit oriented. Other countries under study have defined ways of inspection in drug distribution. South Africa uses their provincial authorities in every province while UK and Netherlands adopts Good Distribution Practice (GDP), where inspectors' monitors' drug distribution from manufacturer to the point of dispensing after it has been registered. The Ghana Food and Drug Board now carries out constant routine inspection of both imported and local facilities for drug regulation, this will gives them a better contact and monitor of activities of drug manufacturers [13] The staff strength in NAFDAC is around 1500 covering the whole states in Nigeria (NAFDAC Consumer safety bulletin, 2007). A country of about 140 million people, this increases the work schedule of staff and can cause inefficiency due to fatigue.

### **Authentication and Authenticating Systems**

Authentication which is gotten from a Greek word as aforesaid in chapter one is the act of confirming the truth of an attribute of a single piece of data (a datum) claimed true by an entity. Authentication is of relevance to many field, in fact it is a way of life. In computer science, verifying a person's identity is often required to secure access to confidential data, information or systems.

(<http://en.wikipedia.org/wiki/authentication>, accessed 04/10/2017)

Authentication can be considered to be of three types or stages; the first is to accept or reject the proof of identity given, the second is to compare the given data with its origin and the third relies on

documentation or other external affirmation. The first two types of authentication are employed by this system.

Authenticating systems are information systems that aid in authenticating an entity is it genuine as it claims. Hence, information systems are system that organizes, collects, collates and communicates as well as store information. The information stored is for management used and for decision making. These systems are business assets, hence the integrity, availability and confidentiality of such systems are paramount in maintain the genuineness of the business [2].

"An information system may be defined as a continuing and interacting structure of hardware, software, people and procedures to collect, sort, analyses evaluate and distribute pertinent, timely and accurate information for use by recipients to enhance better decision making. An information system provides both a data processing capacity and information to help recipients make better decision. The information generated from these systems goes a long way to meet the need of people in a given organization as well as those outside the organization." [24].

Anti-counterfeiting can be done through both digital and manual means. The digital employs the use of technology and digital tools while the manual uses advance printing and graphic techniques like human readable security features, covert features, colour shifting pigment and others. [7].

A single technology can't solve the issue of counterfeiting but when more technologies are put together, just like the case of combination of authenticating factors. A counterfeiter's goal is to maximize profit hence apart from faking low cost high volume consumption product, they also fake products that are and can be easily faked.

What cannot be seen cannot be faked with the exception of a leak-out by a mole. Unique identification codes can't be seen. They are covered and as secret as the

recharge pin and scratch cards. Manufacturers and producers should frequently be abreast in counterfeiting technologies so as to develop theirs and re-strategize. If the feature is difficult to fake then the faker will be discouraged, this call for a more security features in the packing, labeling and graphics of every producing/manufacturing firm. [9].

The authentication system used presently is Mobile Authentication System (MAS). This system is accessed through the sending of Short Message Service (SMS)/USSD to a designated short code owned and manned over by the pharmaceutical company. This system is not available for all drugs as well as packaged foods. Most of the drugs that have this system of authentication are anti-malaria, some antibiotic drugs and diabetic control drugs.

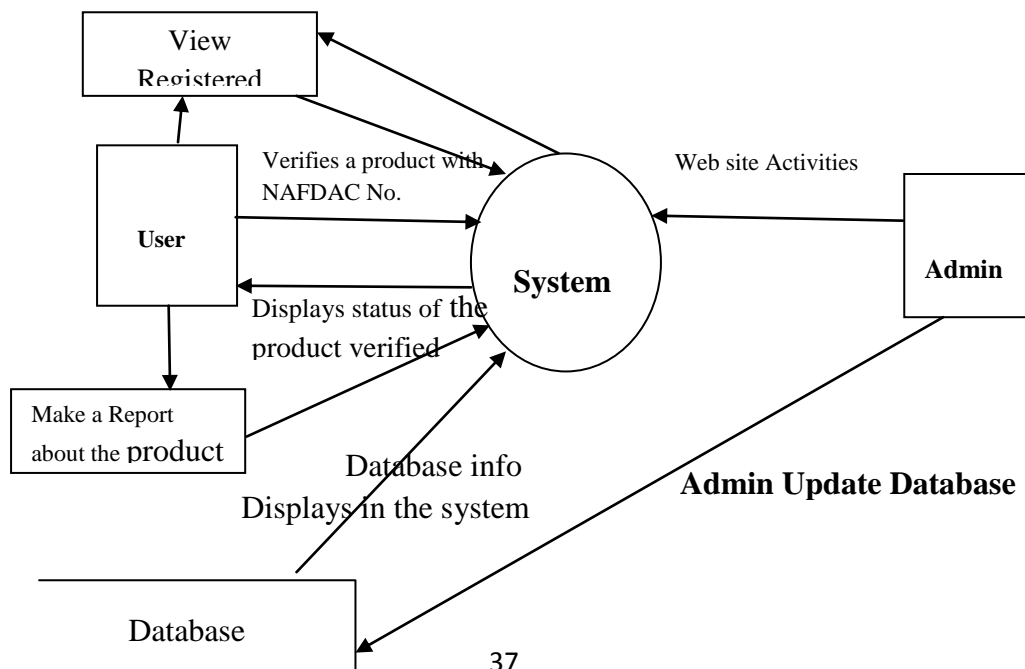
The Mobile Authentication system (MAS) only allows the user to authenticate/verify a drug but in a situation of fake or counterfeited drugs the system doesn't give room to the authenticator to report such drug silently without the seller of the drug knowing. The MAS does not show the manufacturing and expiration date of the verified drug and does not show other

details of the drug such as the serial or batch code or even the contents of drug as they claimed.

The SMS sent by the authenticator is like the command query underneath a button used to query the database of a system. Once the message is sent, the remote system begins to execute the query using the unique code as criteria to getting the query executed and response thereafter. The short code is usually registered with all mobile networks to allow delivering, otherwise, it will fail to send due to wrong number (that is not in the network's legitimate numbering system).

The recent web based verification system launched by NAFDAC is still based on NAFDAC registration number which certifies the company not the actual products they produced, and does not show other details such as serial number, batch code, manufacturing and expiration date of the product which can as well be other factors that can be used to ascertain the authenticity of the product. The system does not capture all consumable drugs. The agency have not come up with unique code to identify every packaged food manufactured in the country as the verification of such product was still based on NAFDAC registration number.

**Figure 1: Data flow Diagram of the Existing Web Based System**



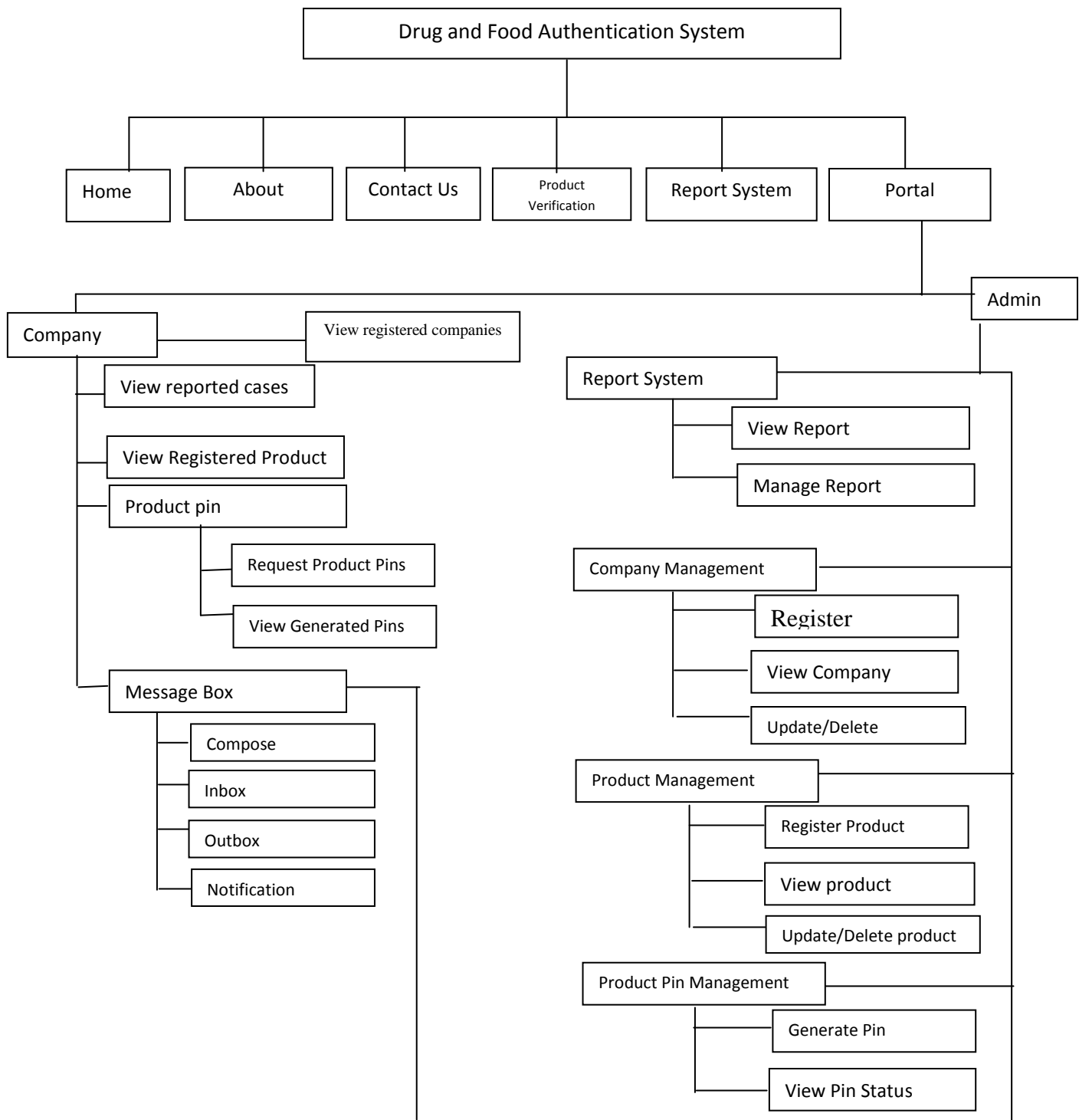
The Above Data flow Diagram, depict the flow of data in existing web based system. User can verify a product by entering NAFDAC number of the product in the system, after which the system checks the number in the database and display the status to the user. If the system displays error or fake product to the user, the user can report the case to system. User can also view registered companies from the system. Admin manages the web site activities, update Database information which in turn displays in the system.

The previous systems of Short Message Service (SMS) and Mobile Authentication System (MAS) necessitated this paradigm shift to developing an Enhanced Food and Drug Authentication. The Short Message Service (SMS)/USSD to a designated short code owned and manned over by the

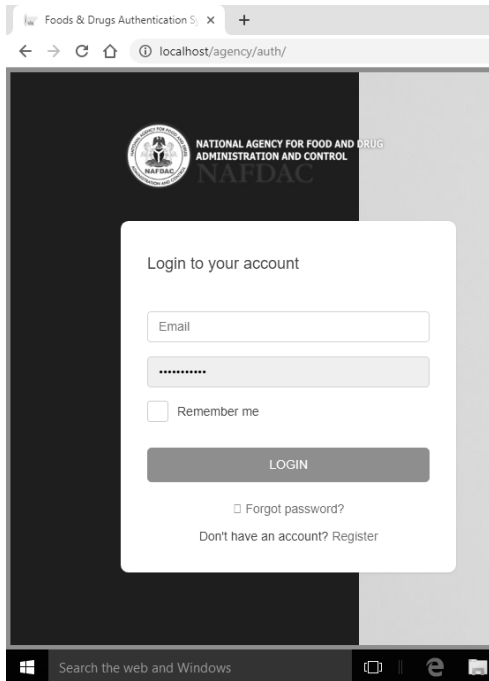
pharmaceutical company. This system is not available for all drugs as well as packaged foods. Most of the drugs that have this system of authentication are anti-malaria, some antibiotic drugs and diabetic control drugs.

The Mobile Authentication system (MAS) became necessary, allows the user to authenticate/verify a drug but in a situation of fake or counterfeited drugs the system doesn't give room to the authenticator to report such drug silently without the seller of the drug knowing. The MAS does not show the manufacturing and expiration date of the verified drug and does not show other details of the drug such as the serial or batch code or even the contents of drug as they claimed.

**Figure 2: High Level Model of the Proposed System**



## Sample Input Forms

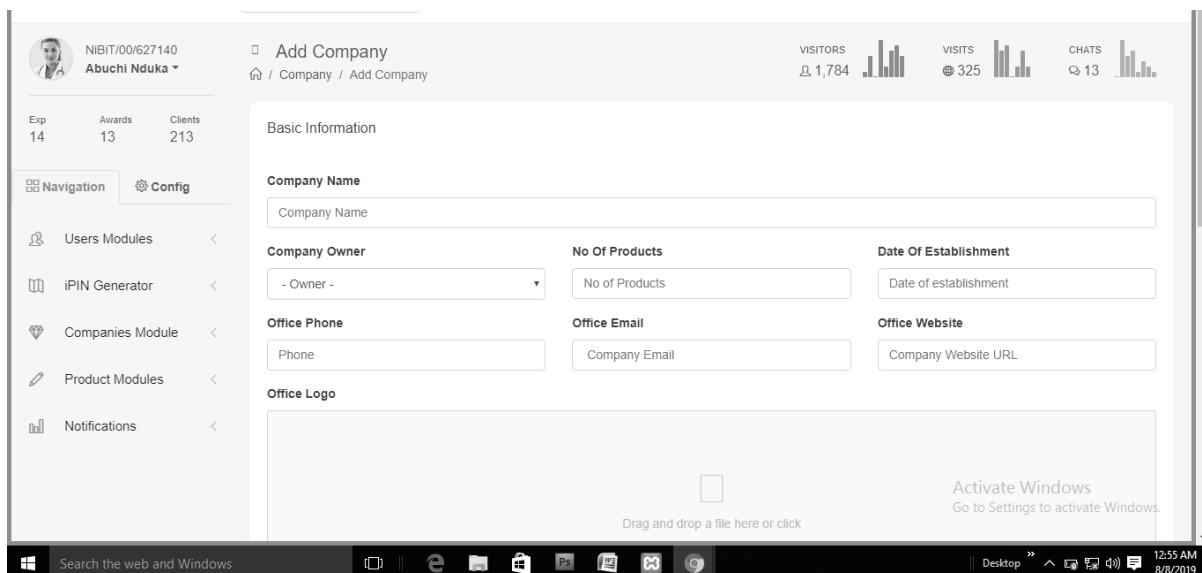


The screenshot shows a web browser window with the URL `localhost/agency/auth/`. The page features the NAFDAC logo and the text "NATIONAL AGENCY FOR FOOD AND DRUG ADMINISTRATION AND CONTROL". A login form is displayed with the following fields and options:

- Login to your account**
- Email input field
- Password input field (masked with dots)
- ☐ Remember me
- LOGIN** button
- ☐ Forgot password?
- [Don't have an account? Register](#)



The screenshot shows the NAFDAC home page with a cityscape background. The page includes the NAFDAC logo and the text "NATIONAL AGENCY FOR FOOD AND DRUG ADMINISTRATION AND CONTROL". A banner displays the date "AUG 08 08 2019 @ NIGERIA". Below the banner, there are two buttons: "Enter The 12 Digit Product PIN" and "VERIFY PRODUCT". The page also features a navigation menu with links: HOME, ABOUT, TESTIMONIALS, FAQ, REPORT A PRODUCT, and PORTAL.



The screenshot shows a user dashboard for a user named "Abuchi Nduka" with the ID "NIBIT/00/627140". The dashboard includes a sidebar with navigation links: Users Modules, iPIN Generator, Companies Module, Product Modules, and Notifications. The main content area displays "Basic Information" for a company, with the following fields and options:

- Company Name**: Input field with placeholder "Company Name"
- Company Owner**: Dropdown menu with option "- Owner -"
- No Of Products**: Input field with placeholder "No of Products"
- Date Of Establishment**: Input field with placeholder "Date of establishment"
- Office Phone**: Input field with placeholder "Phone"
- Office Email**: Input field with placeholder "Company Email"
- Office Website**: Input field with placeholder "Company Website URL"
- Office Logo**: Image upload area with placeholder "Drag and drop a file here or click"

## CONCLUSION



When automated systems are placed side by side with traditional/manual systems, the former always has proved to be more successful with far unique advantages when compared.

This system, food and drugs authentication system has redefined the mobile authentication system in a web application and the loopholes such as the delay in response aforementioned has been addressed. This system because of its speed in response can within microseconds authenticate and perform the database transaction.

The fight against counterfeits and expired foods and drugs has just received a boost if this system will be adopted by NAFDAC. Genuinely expired foods and drugs, which expiry dates were change will no longer be patronized as well as the counterfeited.

Conclusively, counterfeiters can now be reported and tracked down. Even foreign manufactured pharmaceutical and food must pass through same process and necessary measures take if found wanting.

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