SOUTH EASTERN JOURNAL OF RESEARCH AND SUSTAINABLE DEVELOPMENT (SEJRSD) PROF. N.R. NNOROMN.N.C. SAMUEL (Ph.D)

SOUTH EASTERN JOURNAL OF RESEARCH AND SUSTAINABLE DEVELOPMENT (SEJRSD)

Vol. 13 (2), June, 2023

ISSN Print: 2705-201x ISSN Online: 2705-2001

Indexing & AbstractingBodies

2021 Impact factor: 2.75,
Journal Ranking A++

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South Eastern Journal of Research and Sustainable Development Vol. 13(2);
2021 Impact factor: 2.75, ***Journal Ranking A++*** *June,, 2023.*

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ISSN Print: 2705-201x
ISSN Online: 2705-2001

Published in February, 2023

Printed in Nigeria by:
De-Emeralds Printing & Publishing
92 Arthur Eze Avenue, Awka, Anambra State
Tel: 08068511520

Editorial

The South Eastern Journal of Research and Sustainable Development (SEJRSD) is published twice a year online and hard copy. But recently, the journal policy was amended on 10th September, 2021 to be published **monthly**. Thus, the journal begins its monthly publication with volume 6 (1); 2021. It is designed to disseminate knowledge to teachers, teacher-trainees, researchers, curriculum specialists and other interested stakeholders. SEJRSD has continued to serve as an effective instrument for development and innovation in education and equips researchers whose purpose is in development and innovation in educational sector.

The Editor-in-Chief of this Journal is sincerely thankful to the editorial team especially to the numerous subscribers to this volume of the Journal and to all those who has contributed in one way or the other towards making this volume a reality.

Note to Contributors

The South Eastern Journal of Research and Sustainable Development (SEJRSD) is published twice a year online and hard copy. But recently, the journal policy was amended. Thus, the journal hence forth publishes **monthly** (**Every Month**) in a year. The journal publishes peer-reviewed, well researched findings and opinion papers from educators, teachers and other stakeholders in any discipline. The editorial board of SEJRSD therefore requests for original and thoroughly researched empirical and theoretical papers on trending issues in any field.

Note the following:

- Any article submitted for assessment for publication should not exceed 12pages on A4 paper with 12points font size, Time New Roman Face and double line spaced
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- Article must be written in clear and coherent sentences
- The article must be submitted online via the e-mail address: sejrsd@gmail.com
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- The 6th edition of APA (American Psychological Association) referencing style should be used. Avoid footnotes
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EFFORTS AT UTILIZING ICT TOOLS FOR EARLY IDENTIFICATION AND DIAGNOSIS OF MALARIA DISEASE

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Abstract

Malaria disease impose risk to human life and health status. In this paper, a historical background of some of the existing applications of ICT to predicting Malaria Disease is presented. Many organizations globally are involved in campaigning for reducing Malaria disease and equally controlling it. Almost all these efforts are focused on control at various stages of the lifecycle, while less or rare efforts are invested at terminal intervention by the end users. These basically revolve round the smart phone, mainly text parameters; with Internet technology it's also mentioned. The paper is expected to provide background resource for an efficient and effective information system capable of predicting and/or minimizing the risks resulting from this dangerous illness. The ultimate goal is to develop products which will assist in early detection and for use by health-information-related agencies

Keywords: ICT Tools, Diagnosis, Malaria disease

(SEJRSD)

South Eastern Journal of Research and Sustainable Development Vol. 13(2);
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Introduction

Malaria, a potentially fatal condition brought on by Plasmodium parasites, continues to be a major worldwide health concern. Millions of individuals across the globe, especially in tropical and subtropical areas, are afflicted by the illness, which is spread by the bites of female Anopheles mosquitoes that have been infected. When a mosquito bites a person, malaria parasites enter the circulation, where they infect and kill red blood cells, causing a variety of symptoms and serious consequences (Talapko, 2019). An estimated 2 billion people are at risk of contracting malaria worldwide, with 214 million cases recorded in 2016 alone. Tragically, the same year saw a total of almost 438,000 fatalities from malaria (Fornace, 2021).

Young children under the age of five are the most susceptible demographic, with the WHO African Region bearing the brunt of the disease's burden, with an estimated 92% of all fatalities attributed to malaria (Cunningham, 2019). Malaria is still one of the primary causes of children neuro disabilities in various regions of Africa.

The incidence of malaria is ubiquitous in Nigeria by virtue of the rampage and statistics of casualties. Statistically, mortality and morbidity related to malaria is significantly high in Nigeria. Records have shown that out of every ten chronic positive carriers, there are five deaths (World Health Organization, 2018), which suggests rapid mortality from malaria illness. Similarly, malaria morbidity is rapid

and verified records showed that nearly every household in Nigeria is prone to contact (Federal Ministry of Health, 2018). In the disparity, urban area is relatively fair due to active attitude to prevent transmission via mosquito bites unlike rural counterpart which records rapid infections (World Health Organization, 2018). Prevailing records in majority of public hospitals are dominated with treatment of malaria and mortality thereof (National Control for Disease Centre, 2018). Malaria is an illness transmitted through plasmodium of mosquito bites. This makes the illness a pandemic by which more than three quarter of population is susceptible. According to World Health Organization (World Health Organization, 2018), report, the sub-Saharan Africa records highest rate of malaria illness and more than half of deaths in the region is attributed to malaria. The report further stated that incidence of deaths is rapid among children under five and aged population. In another report, rural population is rapidly prone to malaria due to environmental configuration, poor health seeking behavior, inadequate public health centers and accessibility, cost of health care and belief system (National Control for Disease Centre, 2018).

Obviously, the formation and maturation of malaria parasites can be described. There is symptomatic and asymptomatic malaria manifestation. Malaria can be mild, acute and chronic. Clinically, carriers of malaria illness may manifest symptoms which include cold, severe headache, severe convulsion, joint pains, high temperature, and loss of appetite, red eyes, and shortness of breathing and so on. At the same time, malaria carriers may be asymptomatic in this case, none off

the foregoing signs manifested despite harboring the plasmodium (National Control for Disease Centre, 2018).

The vision of WHO and the global malaria community is a world free of Malaria. This goal will definitely be achieved gradually by countries eliminating malaria from their territories and implementing effective measures to prevent re-establishment of transmission. The endemic- malaria countries are situated at different points along the road to put a stop. This progress rate depends on the strength of the national health system, the level of investment in malaria stoppage procedures and other key factors including biological determinants, the environment and the social, demographic, political and economic realities of that country (World Health Organization, 2023).

Again, malaria can be mild which indicates slight headache, temporary loss of appetite and the thereof within reach through self-medication and herbs. Malaria can be also be described as acute and manifestation of symptoms beyond immediate treatment which requires attention of medical doctors and nurses to relieve the carrier. The chronic malaria is a state of emergency which requires urgent attention of medical officers through diagnosis, prognosis and durable treatment paths. This type of malaria is the major cause of deaths and findings have shown that more than half of malaria carriers have manifested in chronic and quick deaths. Yet such manifestation is rapid among under-five children, pregnant women and aged

population. This evidence is inimical to healthy population in the absence of technology to predict occurrence.

In the meantime, malaria is a life-threatening parasite which is contained in spittle of mosquitoes and is transmitted through a bite (Pirnstill, 2015, Razzak, 2015). This takes some 45 minutes to spreadacross entire human blood (Bartoloni, 2012). Descriptively, the infection confronts the body's red blood cells together with liver cells, altering the body's biochemistry and attributes of cells built-structure (Pirnstill, 2015). There are four common species of malaria parasites found in Sub-Saharan Africa and this consisted of *P.falciparum, P. vivax, P. ovale* and *malariae (*Calderaro, 2013).

The *P.falciparum* was regarded as the most common causes of malaria and its severe cases (Gomes, 2013). The *P.falciparum* was attributed to the causes of malaria disease in Sub-Saharan Africa (Howes, 2015).

Statistically, global estimates showed that there were between 300 and 500 million clinical cases annually and with a record of 1-3 million deaths globally (WHO, 2018). The parasite of *P.falciparum* cases of malaria was responsible for an approximate estimate of 40% deaths. With reference to World malaria report of 2015, out of 220 million recorded incidence in the world, there were 881000 deaths (Mohapatra, 2016), and from a total of 200 million incidence of malaria documented in 2017, there were 684000 deaths (Gu,2015).

Incidentally, malaria can be cerebral. Cerebral malaria is anomaly of mental status in a patient with malaria and has a case death rate between 15% and 50%. Cerebral malaria is rapidly progressive and lethal complication of *P.falciparum* infection (World Health Organisation, 2018). It is categorized by unarousable and persistent coma along with regular motor signs. The most vulnerable groups of people are pregnant women, children, and adults with weak immune system. Some studies agreed that the most occurring severity complications of malaria are severe anemia and cerebral malaria National Centre for Disease Control (NCDC) (2018).

World Health Organisation (2023) Cerebral malaria is the most evident cause of neurological complication of malaria infection with *P.falciparum*. The syndrome is clinically characterized by the presence of sexual forms of the parasite and coma caused by any other concomitant disease of these features. Apparently, malaria is a dangerous illness that spurs deadly symptoms in the carriers. Developing model for early detection and prediction therefore becomes indispensable.

Malaria Disease

Malaria detection using machine learning has made considerable strides in recent years, and it has become a potent tool in a number of medical applications, such as illness identification and diagnosis. Since malaria is a common and potentially fatal illness, academics have been interested in finding ways to use machine learning algorithms to increase the efficiency and accuracy of diagnosis.

The use of image analysis for the detection of malaria is one of the major fields where machine learning has had a significant influence. The gold standard for

diagnosing malaria has historically been the microscopic analysis of blood smears. However, this procedure takes a while and calls for knowledgeable professionals. Researchers have used machine learning methods for automated image analysis to overcome these difficulties. They were able to create models that can precisely detect and categorize malaria parasites in blood samples by training algorithms on large datasets of blood smear pictures or simply analysing it associated risk factors Poostchi, Silamut, Maude, Jaeger and Thoma (2018).

Human malaria is a serious problem in sub-Saharan Africa and the risk exists throughout the region (Okwa, 2013). It is a fact that most malaria cases and deaths occur in sub- Saharan Africa. This region has some of the poorest countries of the world with 90% of deaths occurring (approximately 3,000 deaths each day) (World Health Organisation, 2018). Malaria remains one of the leading causes of morbidity and mortality in the tropics. It is the most widespread of the tropical deadly diseases. It exacts a heavy toll of illness and death on children and pregnant women (World Health Organisation, 2018). In 2008, there were 247 million cases of malaria and nearly one million deaths – mainly among children living in sub-Saharan Africa (World Health Organisation, 2018). A child dies every 45 second as a result of malaria, the disease accounts for 20% of all childhood deaths (World Health Organisation, 2018) , 2021). Malaria kills 3,000 children every day in sub-Saharan Africa, that is, a million annually. In sub-Saharan Africa, many

households, also children are familiar with malaria, where it has a reputation of causing teeth chattering chills, shakes and fever.

According to (Okwa, 2013) specific population risk groups include:

1. **Young children** in stable transmission areas who have not yet developed protective immunity against the most severe forms of the disease.
2. **Non-immune pregnant women** are at risk as malaria causes high rates of miscarriage (up to 60% in *P. falciparum* infection) and maternal death rates of 10–50%.
3. **Semi-immune pregnant women** in areas of high transmission. Malaria can result in miscarriage and low birth weight, especially during the first and second pregnancies. An estimated 200 000 infants die annually as a result of malaria infection during pregnancy.
4. **Semi-immune HIV-infected pregnant women** in stable transmission areas are at increased risk of malaria during all pregnancies. Women with malaria infection of the placenta also have a higher risk of passing HIV infection to their newborns.
5. **People with HIV/AIDS** are at increased risk of malaria disease when infected.
6. **International travelers from non-endemic areas** are at high risk of malaria and its consequences because they lack immunity.

7. **Immigrants from endemic areas and their children** living in non-endemic areas and returning to their home countries to visit friends and relatives are similarly at risk because of waning or absent immunity.

Human malaria is a parasitic disease caused by apicomplexan protozoan (single celled) coccidian (Poostchi, 2018, World Health Organisation, 2021). These parasites are haematozoans or haemosporinas of the family plasmodiidae. A contributing factor to the malaria problem in sub-Saharan Africa is the diversity of the parasite that infects humans. Four species infect man of which *Plasmodium falciparium* is the most virulent. The other species are *P. vivax, P. malariae* and *P. ovale.* The *P. falciparium* and *P. vivax* are the most common (World Health Organisation, 2021).

In sub-Saharan Africa, *P. falciparium* poses the greatest threat because of its high level of mortality and the complications arising. *P. vivax* is worldwide in tropical and some temperate regions (Poostchi, 2018), *P. vivax* accounts for more than half of all malaria cases outside sub- Saharan Africa. *P. vivax* is unique in that a sporozoite injected into the blood stream may stay in hepatocytes as hyponozoites. *P. ovale* is mainly found in tropical West Africa and *P. malariae* is found worldwide but with patchy distribution (World Health Organisation, 2021).

These malaria parasites can develop within, invade red blood cells (erythrocytes) and consume up to 75% - 80% of their haemoglobin as nutrient source. For both *P.*

vivax and *P. ovale*, clinical relapses may occur weeks to months after the first infection, even if the patient has left the malarious area. These new episodes arise from "dormant" liver forms (absent in *P. falciparum* and *P.malariae*), and special treatment – targeted at these liver stages – is mandatory for a complete cure (World Health Organisation, 2018).

P. falciparium causes severe complications as cerebral malaria, severe anaemia, acute renal failure, hypoglycemia and pulmonary infection. The two features that actually separate *P. falciparium* from the other human malaria are the ability to attack erythrocytes of all ages, causing high parasitaemia and enhanced growth and the capability to adhere to vascular endothelium through sequestration (Mutanda, 2014), *P. falciparium* is a threat because of high level of mortality and spreading drug resistance. Cerebral malaria caused by *P. falciparium* occurs when infected blood cells obstruct blood vessels in the brain; other vital organs can also be damaged often leading to death of patient (Kokori,2016). Malaria in pregnancy is widespread. Pregnant women are especially vulnerable because of iron deficiency, a special problem in malaria endemic areas. It endangers the health of women and prospects for the new born. Malaria causes anaemia and low birth weight babies. This is due to the loss of previously existing immunity (Okwa, 2013). *P. falciparium* infects the Red Blood cells (RBC) that adheres to and accumulates in the placenta in pregnant women. Pregnancy exacerbates malaria through a nonspecific hormone-dependent depression of the Immune system. The protective anti plasmodial activity is suppressed at pregnancy, which has clinical

consequences with important public health implications on pregnant women (World Health Organisation, 2021).

Malaria accounts for 6.5% abortions, 15% premature deliveries and 0.7% death in utero Pirnstill, and Coté, (2015). Malaria infection leads to increased morbidity and mortality and the delivery of premature infants with low birth weights due to intrauterine growth retardation (IUGR) that may have been as a result of placental parasitisation (World Health Organisation, 2021). Malaria infection in pregnancy is significant in sub -Saharan Africa where its fatality as a result of virulent *P. falciparium* is far greater problem than in most parts of the world (World Health Organisation, 2018). Anaemia is another malaria complication that can lead to death. It occurs when *P. falciparium* disrupts the erythrocytes and so decreases the production of erythrocytes. The pathology associated with *P. falciparium* malaria is in particular due to adherence of infected red blood cells in the brain causing metabolic disturbances and organ dysfunction (Amajoh, 2017). What of the devastating effect on children? Children who succumb to the infection but survive are often left damaged. Recurrent infections can leave the child with poor appetite. It reduces social interaction, leading to poor development. Two percent of children who survive the cerebral form of the disease are left with learning difficulties and conditions such as spasticity and epilepsy Malaria is transmitted by the *Anopheles* mosquito which carries infective sporozoites stage in its salivary glands which it injects into the human blood stream during a blood meal. Several *Anopheles* mosquitoes have been found as major malaria vectors. About 20 different

Anopheles species are locally important around the world. The vector population in sub-Saharan Africa is uniquely effective, with the six species of the *Anopheles gambiae* complex being the most efficient vectors of human malaria in the region, and often considered the most important in the world. *Anopheles funestus* is also capable of producing very high inoculation rates in a wide range of geographic, seasonal, and ecological conditions (Okwa, 2013). These vectors have proven effective in transmitting the malaria parasite to humans across the region, in rural and urban areas alike. *Anopheles pharoensis* is also widely distributed in Africa, geographically and ecologically, and can maintain active transmission of malaria even in the absence of the main malaria vector (Okwa, 2013). All vector species bite at night. They breed in still waters or shallow collections of fresh-water like puddles, rice fields, and hoof prints.

Transmission is more intense in places where the mosquito is relatively long-lived (so that the parasite has time to complete its development inside the mosquito) and where it prefers to bite humans rather than other animals. For example, the long lifespan and strong human-biting habit of the African vector species is the underlying reason why more than 85% of the world's malaria deaths are in sub-Saharan Africa (World Health Organisation, 2021). Mosquito's habits therefore determine the geographic spread of the disease. Malaria transmission is variable from one area to the other and this impact on its epidemiology and control. In a study by (Oyewole, 2010) in a coastal area of southern Nigeria in sub-Saharan Africa, several species of *Anopheles* mosquitoes occurred in sympatry. These

species all combined to the transmission of malaria in the area. They were all competent vectors.

Machine Learning Concept and Classification Recent research has focused on machine learning methods, notably Naive Bayes, Random Forest and Support Vector Machine for their potential in categorizing malaria complications and improving diagnosis. In one study, (Montshiwa, 2022) used the Classification and Regression Tree (CART) in conjunction with Naive Bayes, Random Forest and Support Vector Machine to predict severe malaria cases and estimate the likelihood of sequelae. The models assessed patients based on their symptoms to identify whether they had a severe malaria infection and predicted different sequelae such as convulsions, hypoglycemia, hyperpyrexia, and their combinations. The models' performance was evaluated using measures such as F-score, precision, recall, and accuracy. The findings showed that Naive Bayes, Random Forest and Support Vector Machine can successfully categorise severe malaria and forecast consequences, with an 81.2% accuracy rate for diagnosing hypoglycemia (Montshiwa, 2022). Integrating Naive Bayes, Random Forest and Support Vector Machine into malaria detection efforts may improve diagnostic accuracy dramatically, particularly in resource-limited regions with limited access to experienced medical personnel.

Machine Learning is a study which existed from the area of artificial intelligence that uses a variety of probabilistic, statistical, and optimization techniques to train

computer system in order to scrutinize, "learn" and discern hard patterns in complex, large and noisy data .It is about learning how to do better in upcoming based on experience learned in the past. In this case, it learns to act as an intelligent or predict disease accurately based on some number of observations (Raj, 2014).

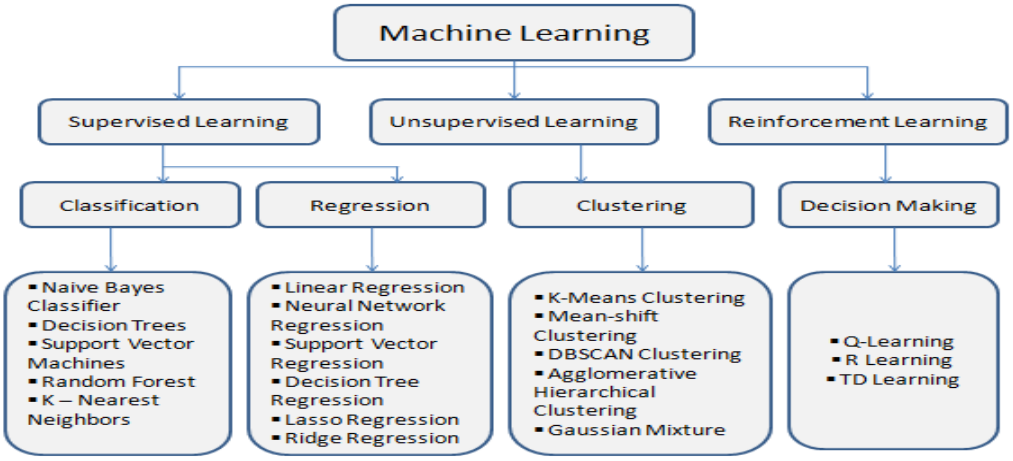


Figure1: Machine learning analytics by Sabitha Rajbanshi, Vidhya App, March 30, 2021

The objective is to develop learning algorithms that can learn automatically without human assistance or intervention. Machine learning can be applied when people are susceptible to making mistakes at the time of analysis or, perhaps, when trying to create relationships between many features. It is used for improving the efficiency of a system as well as designs of machines (Archana, 2014). Machine learning provides an alternative solution to a medical problem by using different

techniques such as clustering and classification applied on previous real data to predict current disease**.** This approach was found stimulating by many researchers trying to use medical data to predict disease (Durairaj, 2013).

Mobile Phone Technology

In this section, a general review of mobile telephone technology, including voice and text technology, is presented. Short Message Service (SMS) is one of the applications of mobile telephone technology. Only brief information about how mobile phone works is sufficient to understand the SMS function. In particular, text messaging eliminates any ambiguities and misunderstandings in voice communications.

YEAR	NUMBER OF CONNECTED DEVICES
1990	0.3 million
1999	90.0 million
2010	5.0 billion
2013	9.0 billion
2025	1.0 trillion

Table 1. IoT prospects as estimated by Hewlett Packard (HP) [33]

History of Mobile Phone

In 1973, Martin Cooper invented the first personal handset while working for Motorola. He took his new invention, the Motorola Dyna-Tac., to New York City

and showed it to the public. He is credited as the first person to make a call on a portable mobile-phone. Although the history of cell phone can be traced back to 1843 when Micheal Faraday, a talented chemist, began to do research on the possibility that space can conduct electricity, Cooper's research kick-started the wheels for many other 19th century scientists. In 1865 A Virginia, USA Dentist/Scientist, Mahlon Loomis, developed a method of communicating through the earth's atmosphere by using an electrical conductor. He did this by flying two kites, that are rigged with copper screens and wires, which are connected to the ground on two separate mountains about 18 miles apart. He later received a grant from the U.S. Congress for $50,000 (Keith, 2014).

Cellular Communication Network

In this sub-section, the evolution of cellular communication from the period of 0G to 5G is presented (Sood, 2014).

0G- Zero Generation

The story of the modern mobile phone really began in the 1940s when engineers working at AT&T developed cells for mobile phone base stations. The very first mobile phones were not really portable at all. They were two-way radios – means using half duplex technique (the caller would have to release the button to hear the other person; it was initially used mainly in military or other emergency services. This generation refers to pre-cell phone mobile telephony technology, such as radio telephones that some people had in cars before the advent of cell phones i.e. mobile

radio telephone systems preceded modern cellular mobile telephony technology. Technologies used in 0G systems included PTT (Push to Talk), MTS (Mobile Telephone System), IMTS (Improved Mobile Telephone Service), and AMTS (Advanced Mobile Telephone System) (Bhalla, 2010)

1G-First Generation

The period covers 1970s to1980s; the mobile device was large in size, and would only fit in the trunk of a car. All analog components such as the power amplifier, synthesizer, and shared antenna equipment were bulky. 1G systems were intended to provide voice service (call only) and low rate. The first-generation handsets provided poor voice quality, low talk- time, and low standby time. The 1G systems used Frequency Division Multiple Access (FDMA) technology and analog frequency modulation, Garg, (2007)**.** The system in this generation system was analog in nature and used Frequency Division Multiple Access (FDMA). Martin Cooper, a researcher and executive at Motorola, is credited with being the first person to make a call on a portable mobile-phone in 1973. The prototype handheld phone used by him weighed 1.1 kg and measured 23 cm long, 13 cm deep and 4.45 cm wide. The prototype offered a talk time of just 30 minutes and took 10 hours to re-charge.

2G-Second Generation

This period of 1980 to 2000 is characterized by fully digitalized technology. The period also led to the evolution of 2.5 G which was characterized by EDGE

technique. 2G phones using global system for mobile communications (GSM) were first used in the early 1990s in Europe. GSM provided voice and limited data services, and used digital modulation for improved audio quality. The development of 2G cellular systems was driven by the need to improve transmission quality, system capacity, and coverage. Further advances in semiconductor technology and microwave devices brought digital transmission to mobile communications. Speech transmission still dominated the airways, but the demand for fax, short message, and data transmission is growing rapidly. Supplementary services such as fraud prevention and encryption of user data have become standard features, comparable to those in fixed networks. The mobile technology using general packet radio service (GPRS) standard has been termed as 2.5G. 2.5G systems enhance the data capacity of GSM and mitigate some of its limitations.

3G-Third Generation

This period is mainly on broadband technique and the communication is faster than ever before, and this period saw the birth of WCDMA (Wideband Code Division Multiple Access) and HSPA (High Speed Packet Access) technologies. The third generation mobile technology is based on wide band wireless network and complied with the International Mobile Telecommunications-2000 (IMT-2000) specifications by the International Telecommunication Union. The communication provides enhanced clarity and perfection like the real conversation. Recent 3G releases provide mobile broadband access of several M bit/s to smart phones and

mobile modems in laptop computers. 3G offers a vertically- integrated, top-down, service-provider approach to delivering wireless Internet access. 3G is a technology for mobile service providers. Mobile services are provided by service providers that own and operate their own wireless networks and sell mobile services to end users, usually on a monthly subscription basis. Mobile service providers use licensed spectrum to provide wireless telephone coverage over some relatively large contiguous geographic serving area. The IMT-2000 framework sets the following goals for the so called 3G wireless systems: Global standards to allow for low cost and worldwide roaming. High Quality of Service (QoS) especially for voice. Support for advanced services: Multimedia, Bandwidth on Demand, High speed data (Morufu, 2020).

4G-Fouth Generation

The 4G (fourth generation) of mobile phone mobile communications is a successor of the third generation (3G) standards. A 4G system provides mobile ultra-broadband Internet access, for example to laptops with USB wireless modems, to Smart-phones, and to other mobile devices. Conceivable applications include amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing and 3D television. Recently, Android and Windows-enabled cellular devices have fallen in the 4G category. One base advantage of 4G is that it can at any point of travelling time provide an internet data transfer rate higher than any existing cellular services (excluding broadband and Wi-Fi

connections). Two 4G candidate systems have been commercially deployed: the Mobile WiMAX+ standard (at first in South Korea in 2006), and the first release Long Term Evolution (LTE) standard (in Scandinavia since 2009) (ITU, 2020).

5G-Fifth Generation

The Consumer expectations for mobile broadband service quality are growing in parallel with traffic complexity and increase usage (ITU, 2020). There is expectation that this generation will be given birth by the year 2020. Complex and constantly evolving multi-vendor networks and services are placing considerable demands on service management. The next wave of the Digital Society will be characterized by an ICT network's capability for immediate service availability and on-demand adaptability. The technologies behind 5G architecture are: - a) Nano Equipment b). Cloud computing. c). IP platform.

History of SMS

As stated by European Telecommunications Standards Institute [36], the origin of the text messaging services in GSM lies in the historical development of telecommunication services, and SMS was created by a small group of persons. The work on the standardization of services and the technical realization was approved by the CEPT Groupe Spécial Mobile. Text messaging was a known telecommunications service years before the development of GSM started in 1982. Proposals for text messaging as a service in GSM were made by Nordic, German

and French operators, who were all co-operating in the task. The Nordic operators focused their work on text messaging by using an access to a message handling system, a service similar to e-mail. This service was standardized by the GSM committee and led to a technical report on the technical realization of the access to Message Handling Systems.

The German and French operators focused their work on 'Short Message Transmission'. This service used a dedicated service centre and transmits the text messages over existing signaling paths of the GSM telephony system on a lower priority basis. This transmission method obviously constrains the message to be short: the maximum length, initially estimated as 128 octets, later optimized to 160 characters, is still sufficiently long for most personal or professional purposes.

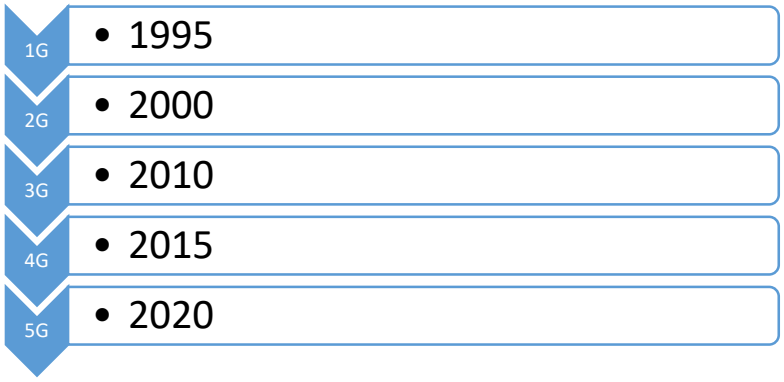
Mobile phone services (SMS) are important because the growth of cell phones in Nigeria, and Africa in general exceeds 65% and is considered one of the fastest in the world. Research shows that in typical rural district of Africa, about 80% of households make regular use of phones. One of the key features driving growth in mobile phones (also known as handsets) is that they are movable and inherently suited to remote area with poor infrastructure. In addition, the prepaid system of low denomination scratch cards is perfectly matched to economic situation of many people. It is recognized that mobiles offer potentially cheap means of communicating, especially through the use of SMS and beeping.

Discussion

Current statistics indicate that as at 2021, the number of mobile subscription in the particular case of Nigeria was 172.73 million, as released in September 2022 (www.statista.com). It need be noted that the statistics on the number of mobile cellular subscriptions (in Nigeria) is not the same as the number of people (Nigerians) using cell phones. This is due to the simple logical fact that a subscriber may have more than one cell phone. Also, subscribers who are corporate organizations are not counted as human beings.

At the end of 2022, 53.6% of the world population are using the internet. This translates to 4.1 billion people, using an estimated global population of 7.6 billion (Uwazie, 2020) Apart from number of mobile cellular subscription per country per year, (Uwazie, 2020) also provides, among others, yearly statistics on Global System of Mobile Communication (GSM).

Figure 2- Mobile Network Evolution Timeline



Conclusion

In this paper, a historical review of the information system of Malaria Disease prediction is presented. This includes the use of different approaches of controlling the disease, from documentation, manufacturing, distribution, and then to administration. The number of fixed telephone subscription and number of individuals using the internet. A key global forum for the discussion of issues relating to telecommunication and ICT measurement is the World Telecommunication/ICT Indicators Symposium (WTIS). This is an annual gathering of experts in information society measurement, and also of policy makers and implementers. The patient with early malaria disease detection and grading with the chosen parameters by using phone/ ICT gadgets to do the prediction? This research paper made us to realize that Malaria disease can be treated with some

parameters of a clean environment, with or without visiting doctors and equally eradicated with the availability of treated net, basic infrastructures based on the environment/houses patient they live, and detection of symptoms to reduce the severalty of the disease.

This study made us to realize that Malaria disease can be treated with some parameters to be inputted like vital signs on phone such as a clean environment, with or without visiting doctors and equally eradicated with the availability of treated net, basic infrastructures based on the environment/houses patient they live, and detection of symptoms.

Recommendations

What is the rate of patient with early malaria disease detection and grading with the chosen parameters by using phone/ ICT gadgets to do the prediction? This research paper made us to realize that Malaria disease can be treated with some parameters of a clean environment, with or without visiting doctors and equally eradicated with the availability of treated net, basic infrastructures based on the environment/houses patient they live, and detection of symptoms to reduce the severalty of the disease.

References

Amajoh, N, Odukoko, J.B. & Monsanya, M.E. (2017). Preliminary investigations on malaria and anemia in the Atlantic coastal margin of Ibeju Lekki, Lagos Nigeria. *Journal of Malaria in Africa and the Tropics*, *1*, 17-22.

Archana, S. & Elangovan, K. (2014). Survey of classification techniques in data mining. *International Journal of Computer Science and Mobile Applications*, *2*(2), 65-71.

Ashiho, L. (2003) "Mobile Technology Evolution from 1G to 4G", Electronics For You, June, pp. 94-98.

Bartoloni, A. & Zammarchi, L. (2012). Clinical aspects of uncomplicated and severe malaria. *Mediterranean Journal of Hematology and Infectious Diseases*, *4*(1).

Bhalla, M. R. & Bhalla, A. V. (2010). "Generations of Mobile Wireless Technology: A survey", International Journal of Computer Applications, 4; 26-32

Calderaro, A., Piccolo, G., Gorrini, C., Rossi, S., Montecchini, S., Dell'Anna, M.. & Arcangeletti, M. (2013). Accurate identification of the six human Plasmodium spp. causing imported malaria, including Plasmodium ovale wallikeri and Plasmodium knowlesi. *Malaria Journal*, *12*(1), 321.

Cunningham, J., Jones, S., Gatton, M. L., Barnwell, J. W., Cheng, Q., Chiodini, P. L., Glenn, J., Incardona, S., Kosack, C., & Luchavez, J. (2019). A review of the WHO malaria rapid diagnostic test product testing programme (2008–2018): performance, procurement and policy. *Malaria journal*, *18*, 1-15.

Durairaj, M. & Ranjani, V. (2013). Data mining applications in healthcare sector: A study. *International Journal of Scientific & Technology Research*, *2*(10), 29-35.

ETSI.ETSI-Cellular History (2012). Retrieved in 2014, from ETSI.org: http://www.etsi.org/index.php/technologiesclusters/technologies/mobile/cellular- history

Fornace, K. M., Diaz, A. V., Lines, J., & Drakeley, C. J. (2021). Achieving global malaria eradication in changing landscapes. *Malaria journal*, *20*(1), 1-14.

Garg, V. (2007) Wireless Communication and Networking. San Francisco, CA: Morgan Kaufman Publisher.

Gomes, A. P., Vitorino, R. R., Costa, A. D. P., Mendonça, E. G. D., Oliveira, M. G. D. A. & Siqueira-Batista, R. (2011). Severe Plasmodium falciparum malaria. *Revista Brasileira de Terapia Intensiva*, *23*(3), 358-369.

Gu, X., Chen, H. &Yang, B. (2015, October). Heterogeneous data mining for planning active surveillance of malaria. In *Proceedings of the ASE Big Data & SocialInformatics*, p.44 34

Howes, R. E., Reiner Jr, R. C., Battle, K. E., Longbottom, J., Mappin, B., Ordanovich, D. & Smith, D. L. (2015). Plasmodium vivax transmission in Africa. *PLoS neglected tropical diseases*, *9*(11), 42-50

https://www.itu.int/en/ITU-D/Statistics/Pages/ <last accessed in March 2020>

Kefela, G. (2011).“The impact of mobile phone and economic growth in developing countries”, African Journal of Business Management, 5(2), 269-275.

Keith, R. (2004). Cell Phone Timeline, 2004. Retrieved in 2013, from Interactive Media Lab, University of Florida: http://iml.jou.ufl.edu/projects/fall04/keith/history1.htm

Kokori, M., Inuwa, A. M., Babakura, M. & Garba, A. M. (2016). Body temperature trends and fever risk in the parasitaemia of Plasmodium Falciparum treated children at lake-alau , Borno state , *North Eastern Nigeria, 5*(9), 1684–1689.

Mohapatra, B. N., Jangid, S. K. & Mohanty, R. (2016). GCRBS score: a new scoring system for predicting outcome in severe falciparum malaria. *The Journal of the Association of Physicians of India*, *62*(1), 14–17.

Montshiwa, T. V., & Botlhoko, T. (2022). Stepwise logistic regression, hierarchical logistic regression, CART and Naïve Bayes for predicting learners' numeracy test results.

Morufu, A. and Bamidele, O. (2020), A Historical Background of Some Basic ICT Tools used in Counterfeit Drug Control © 2020 Afr. J. Comp. & ICT . 13, (1); 52 – 61.

Mutanda, A. L., Cheruiyot, P., Hodges, J. S., Ayodo, G., Odero, W. & John, C. C. (2014). Sensitivity of fever for diagnosis of clinical malaria in a Kenyan area of unstable, low malaria transmission. *Malaria Journal*, *13*(1), 163.

Nabhan, M.A. (2009). Adaptive, Reliable, And Accurate Positioning Model for Location Based Service LBS, PhD Thesis. West London: Brunel University, School of Engineering and Design.

Okwa, O.O. (2013). The status of malaria among pregnant women: A study in Lagos, Nigeria. *African Journal of Reproductive Health, 7 (3)*: 77– 83

Oyewole, I.O, Ibidapo, C.A, Okwa, O.O, Oduola, A.O, Adeoye, G.O, Okoh, H.I. & Awolola, T.S. (2010). Species Composition and Role of Anopheles Mosquitoes in Malaria Transmission along Badagry axis of Lagos Lagoon, Lagos, Nigeria. *International Journal of Insect Science, 2*, 51–57

Pirnstill, C. W. & Coté, G. L. (2015). Malaria diagnosis using a mobile phone polarized microscope. *Scientific reports*, *5*, 13368.

Poostchi, M., Silamut, K., Maude, R. J., Jaeger, S., & Thoma, G. (2018). Image analysis and machine learning for detecting malaria. *Translational Research*, *194*, 36-55.

Razzak, M. I. (2015). Automatic detection and classification of malarial parasite. *International Journal of Biometrics and Bioinformatics (IJBB)*, *9*(1), 1–12.

Shukla, S. , Khare, V. , Garg, S. & Sharma, P. (2013) "Comparative Study of 1G, 2G, 3G and 4G", *Journal of Engineering, Computers & Applied Sciences (JEC&AS)*, 55-63.

Sood, R. & Garg, A. (2014)."Digital Society from 1G to 5G: A Comparative Study". *International Journal of Application or Innovation in Engineering & Management (IJAIEM)*, 186,

Talapko, J., Škrlec, I., Alebić, T., Jukić, M., & Včev, A. (2019). Malaria: the past and the present. *Microorganisms*, *7*(6), 179.

Uwazie, E., Abah, J. B. & Temitope O. A. (2020), A Survey of Some Key Characteristics of Internet of Things. 13 (1), 62 – 75

World Health Organisation (2018): Malaria fact sheet No 98, October. http://www.who.int/mediacentre/factsheets/fs094/en/

World Health Organisation (2023): Malaria fact sheet No 98, October. http://www.who.int/mediacentre/factsheets/fs094/en/

World Health Organisation (2021): Malaria fact sheet No 98, October. http://www.who.int/mediacentre/factsheets/fs094/en/

www.statista.com/statistics/501044/number-of-mobilecellular-subscriptions-in-nigeria <last accessed in March 2020>