



(RESEARCH ARTICLE)



Portfolio on Web-Based Medical Record Identification system for Nigerian public Hospitals

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Abstract

Patient record management is an important aspect of healthcare delivery in hospitals. It involves the creation, maintenance, and retrieval of patient records, which contain vital information about a patient's medical history, diagnosis, treatment, and outcomes. Effective patient record management ensures that healthcare professionals have access to the right information at the right time, which is critical for making informed decisions about patient care. In Nigerian public hospitals, identifying patients' records poses a challenge as there is no automated method of record management. Files are being carried from one table to another during treatments, thereby causing delays in attending to patients, which sometimes leads to worst conditions as death. To the best of our knowledge, there is no study targeting this problem of public hospitals or any that addressed this problem hitherto. To cover this gap, we designed a web-based medical record identification system for Nigerian public hospitals. Much novelty of the system lies on empowering patients with a prompt of their access codes when they are registered with the system. Qualitative approach and agile methodology were adopted for this study. A user study was done to confirm the functionality of the system and feedback concerns were handled appropriately. While this work contributes to the scientific body of IT knowledge and highlights the steps of preparing portfolio of evidence in computing, it addresses the record management issues in Nigerian public health system.

Keywords: Portfolio; Patient; Identification system; Record; Management

1. Introduction

1.1. Problem identification

Web-based record identification technology (WRID) has been widely used in various industries for inventory management, facilitating information retrieval and processing (Hanauer et al., 2015). In recent years, web-based identification has also been increasingly adopted in the healthcare industry to improve patient safety, streamline operations, and enhance the overall patient experience (Cowie et al., 2017). One potential application of WRID technology in healthcare is for medical record identification.

Gumus (2023) posits that traditional paper-based medical records is presently used in Nigerian public hospitals, and patients' files are still being carried from one table to another as patients are attended to by medical personnel. This delay has worsened patients' medical condition and in some cases, increased mortality rate because of poor file management and data mismatch (Abubakar, 2022). Apart from this, paper-based approaches can be cumbersome and prone to errors, leading to inefficient healthcare delivery and potentially compromising safety as wrong treatment is administered to the wrong patient. To help address this issues, we propose a Web-based medical record identification

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system which will enable quick and accurate identification of patient records, even in a busy and fast-paced healthcare environment.

According to Gumus (2023), there are several potential benefits of WRID medical record system. First, it could improve patient safety by reducing the risk of medical errors due to misidentification or incorrect patient information. Second, it could streamline healthcare operations by reducing the time and effort required to locate and retrieve patient records. This technology could enhance the overall patient experience by reducing wait times and improving the accuracy and efficiency of healthcare delivery Joseph et al. (2020).

With WRID medical record system, patients would be given a unique identification code that would contain their medical record information. This code could be stored in their smartphones or written down, and would be entered into the WRID system located throughout the healthcare facility. The system would then quickly and accurately identify the patient's medical record and pull up their information, which could include their medical history, allergies, current medications, and other important health information.

WRID medical record system has the potential to improve patient safety, streamline healthcare operations, and enhance the overall patient experience (Joseph et al., 2020).

1.2. Challenges

We are aware of potential challenges and considerations to be taken into account when implementing WRID medical record system. These include concerns about patient privacy and data security, as well as the cost and logistics of implementing the necessary WRID infrastructure and training healthcare personnel to use the system effectively (Zhan & Xuan, 2021). However, careful consideration is to be given to the potential challenges and considerations before implementing this technology.

Objective of the study

The objective of the study is to implement web-based record identification technology in the Nigerian public hospital settings. Specifically, the study would aim to:

- Design a Web-based identification system, which will improve patient safety, streamlined healthcare operations, and enhanced patient experience.
- Provide healthcare organizations with a comprehensive informed decision mechanism in their operations.
- Assess the potential challenges and considerations associated with WRID medical record system, including patient privacy and data security, cost and logistics of implementation, and healthcare personnel training.
- Analyze the existing literature on WRID technology in healthcare, with a focus on medical record identification.
- Identify best practices for implementing WRID medical record system, including considerations for system design, infrastructure, and personnel training.
- Provide recommendations for healthcare organizations considering implementing WRID medical record system, based on the findings of the study.

Significance of the study

WRID medical record system is relevant in advancing our understanding of this technology and its potential impact on healthcare delivery, patient safety, and patient experience. Hence, this study would be significant for the below reasons:

- Improved patient safety: By reducing the risk of medical errors due to misidentification or incorrect patient information, WRID medical record system could help improve patient safety, a critical goal for healthcare organizations.
- Streamlined healthcare operations: By reducing the time and effort required to locate and retrieve patient records, WRID medical record system could help healthcare organizations improve their operational efficiency and reduce costs.
- Enhanced patient experience: By reducing wait times and improving the accuracy and efficiency of healthcare delivery, WRID medical record system could enhance the overall patient experience, leading to higher patient satisfaction and loyalty.
- Contribution to the literature: The study would contribute to the growing body of literature on WRID technology in healthcare, specifically focusing on medical record identification. This would help to advance our understanding of the potential benefits and challenges of this technology, and to identify best practices for its implementation.

- Guidance for healthcare organizations: The study would provide guidance and recommendations for healthcare organizations considering implementing WRID medical record system, helping them to make informed decisions and navigate the potential challenges of this technology.

2. Literature review

Several studies have investigated the use of technology for medical record identification, including barcode technology, radio-frequency identification (RFID), and biometric identification. These technologies have shown promise in improving accuracy and efficiency in medical record identification (Coustasse et al., 2015). However, RFID is costly to implement especially in developing countries like Nigeria.

Dernoncourt et al. (2017) explored the identification of medical record, while anonymizing medical data against intruders, using artificial neural network (ANN). Their system was able to encrypt medical data, keeping it confidential to the core. This study was limited by its dual output specification that gave rise to database redundancy, which our proposed system will correct.

In another study, Dubovitskaya et al. (2017) used block chain technology to create identification mechanism, while protecting electronic health data. Their system was faced with rejection as the user study revealed, because of intricacies in block chain data.

Shickel et al. (2017) conducted a study on handling divergent medical data, and concluded that medical record identification is critical for patient care, as it ensures that patient information is accurately recorded and can be easily accessed by healthcare providers. Accurate identification also helps to avoid errors and improve patient safety. (Shickel, 2017). In their study, Handayani et al. (2018) revealed that user training, system usability, and user feedback are important factors that influence user acceptance and adoption.

Weng et al. (2019) posits in their study that despite the importance of accurate medical record identification, there are several challenges associated with it. These include duplicate records, incomplete records, misspelled names, and patient identification errors. (Weng et al., 2019). Medical record identification systems also raise legal and ethical considerations, including patient privacy and confidentiality, data security, and compliance with regulatory requirements such as HIPAA. It is important for healthcare providers to address these considerations when implementing a medical record identification system. (Zhao et al., 2018).

This study will take care of the above mentioned concern and lapses in the literature.

According to Maulani et al. (2019), a web-based system can streamline the process of data management, resulting in improved efficiency and accuracy. It eliminates the need for manual record-keeping, reduces errors, and prevents duplication of tests and procedures.

Effective coordination and communication among healthcare providers are vital for providing high-quality care. A study by Bolton et al. (2021) emphasizes that web-based medical record identification systems enable seamless access and sharing of patient information among different departments or hospitals. This promotes better collaboration, faster decision-making, and improved patient outcomes.

The empowerment of patients through access to their medical records is a key benefit of web-based systems. In their research, Keshta and Odeh (2021) highlight that patients having secure online access to their medical information enables them to make informed decisions about their healthcare. This involvement and engagement in their care plans lead to better treatment adherence and overall health outcomes.

The implementation of a web-based medical record identification system contributes to the modernization of healthcare infrastructure in Nigeria. Muinga et al. (2020) discuss that adopting digital solutions in public hospitals not only improves the quality of care but also attracts investment and partnerships with international healthcare organizations. It promotes a culture of innovation and technological advancement in healthcare delivery.

While the potential benefits are significant, the implementation of a web-based medical record identification system in Nigerian public hospitals also presents challenges. Data security and privacy concerns are among the primary issues highlighted by several studies (Bolton et al., 2021; Keshta & Odeh, 2021). Adequate technical infrastructure, including reliable internet connectivity, is also crucial for the system's effectiveness.

To conclude, the existing literature emphasizes the potential of web-based medical record identification systems in Nigerian public hospitals. These systems have the capacity to enhance data management, improve coordination and communication, empower patients, and modernize healthcare infrastructure. However, it is essential to address challenges related to data security, privacy, and technical infrastructure. Further research and comprehensive planning as presented by our study are necessary as it will offer full benefits using web-based medical record identification mechanism in Nigerian public hospitals.

2.1. Needs assessment

The specific need for record identification software in Nigerian public hospitals is the improvement of efficiency and accuracy of medical information. Since the medical sector is facing medical record identification issues, and presently use manual system, the proposed system is highly relevant.

The stakeholders of Nigerian public hospitals, through the health Minister, have also given nod to the proposed system.

The records to be identified are textual and pictorial data, and the proposed system will accommodate unlimited data on daily basis since it is web-based.

Our gap analysis shows that the health officers carry patients’ files from table to table during hospital visits, thereby wasting time and giving room for data loss as the file can be misplaced. Based on the findings of the gap analysis, the specific requirement for the new system is personal computers and internet.

Designing a web-based medical record identification system will help in reducing the issues identified in the record keeping system of Nigerian public hospitals.

The timeline for the proposed system is one month.

Once the system is designed, there will be a user study to identify flaws in the system. The feedback collected will be investigated so as to identify areas of improvement. Therefore, the proposed system will be widely adopted in public hospitals in Nigeria, and as such, success is assured.

3. Methodology

There is no best research methodology anywhere (Choy, 2014). One choice may help a design team achieve a huge success in a project, but fails them in another project. Hence, it is advisable to understand a project before choosing its methodology (Baijens et al., 2020). The agile product management model was adopted for the proposed system. The justification of the choice of this model lies on its flexibility, collaboration, and continuous improvement features. In this model, the product development process is broken down into short iterations, usually 1-4 weeks, known as sprints (Al-Saqqa et al., 2020).

3.1. Project plan

According to Raharjo and Purwandari (2020), every agile oriented project must have a plan with a specific time frame. Below is the plan of the proposed project.

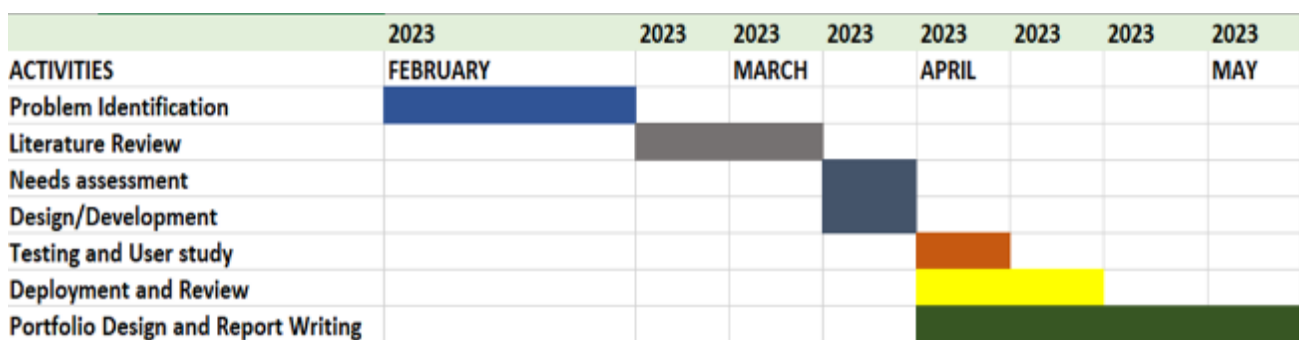


Figure 1 This is timeline of this study and design of the proposed system

3.2. System design

This is the combination of tools to create a functional system. The tools combined were: Low fidelity prototype tools, User personas, input and output specification tools, Dreamweaver and MySQL.

3.2.1. Choice of programming language

The system was designed using Wordpress, which is a visual editor for designing front ends, leveraging on templates. The Wordpress uses embedded HTML codes to interact with objects used in web interfaces. Furthermore, PHP was used to link the interface objects to MySQL database, which handles the back end functionalities. Combining these two tools, produced the output shown in figure 5.

3.2.2. Low fidelity (Paper sketch) prototype

A low fidelity prototype is a hand sketch of the look of a web-based application for team discussions and deliberations (Suleri et al., 2019). For the proposed system, a low fidelity prototype was sketched as shown in fig 2. This was earlier developed exactly into the web-based interface as shown in fig 4.

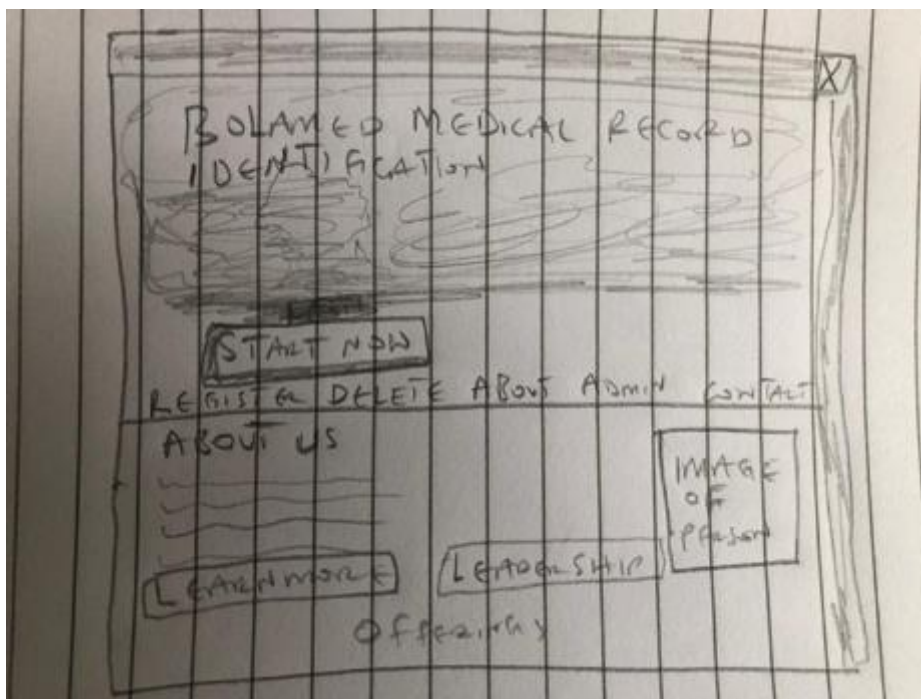


Figure 2 Paper sketch prototype

3.3. User Persona

A user persona is an imaginary character that represents a specific group of users and their behaviors, goals, motivations, and preferences (Ferreira et al., 2015). According to Huh et al. (2016), user personas are created based on user research, including surveys, interviews, and observation, to help designers, marketers, and product developers better understand the needs and expectations of their target audience. Two users were identified for the proposed system. The first user is Mrs Ann Bolaji, who is a receptionist in a Nigerian public hospital, while the second user is a patient whose file had been misplaced because of manual record identification problems.

3.3.1. *Persona 1: Mrs Ann Bolaji (not real name) - Hospital receptionist*

User Persona

Ann is a receptionist in a Nigerian hospital. She wants to use the web-based application to identify the record of a patient who has arrived to see the Doctor.



Mrs Ann Bolaji
Age: 43
Country: Nigerian
Marital Status: Widow

Scenario

User Story

Mrs Ann Thomas is a receptionist in the hospital who wants to search for a patient's medical record. Previously, she would go into the file room to trace a patient's file manually. Presently, Ann wants a web-based system that will enable her to view the file of the patient on her computer screen, using a file number.

Technology

1. Ann is Computer literate
2. She can use both android and apple phone
3. She is good with social networks
4. Ann is good with oval buttons

Personality

1. Ann is an Extrovert
2. Ann drinks alot
3. Ann thinks alot
4. Ann is sociable

Goals and needs

The goal of Ann is not to stress her self while attending to patients, and her need is to do her work seamlessly.

Frustration


Ann is always lonely

Figure 3 This is the user persona that describes the characteristics of the receptionist user

3.3.2. *Persona 2: Ikenna Henry(not real name)-Patient*

User Persona

Ikenna Henry is a patient that receives treatments in one of the Nigerian public hospitals. He wants to register himself using the web-based application, so as to save himself long waiting time whenever he visits the hospital.



Ikenna Henry
Age: 22
Country: Nigerian
Marital Status: Single

Scenario

User Story

Ikenna Henry is a Nigerian youth who wants to register himself as to easily access medical services. Previously, Henry was given medication that belongs to another patient. Presently, he needs a web-based system that can help identify his records with ease. This would help prescriptions to be properly attached to his records without errors.

Technology

1. Henry is Computer literate
2. He can use both android and apple phone
3. He is good with social networks
4. He is good with oval buttons

Personality

1. Henry plays table tennis alot
2. He does not dring alcohol, but he smokes
3. Henry is still an undergraduate student
4. Henry is sociable

Goals and needs

The goal of Henry is to get himself registered into the web-based system, as to be easily identified anytime he visits the hospital.

Frustration

Henry is always busy with studies

Figure 4 This is the user persona that describes the characteristics of the patient user

3.4. Input Specification

The input form consists of an orange header area with two input fields: 'Patient's name' and 'Email'. Below these is a 'Medical Details' input field. A 'Generate Code' button is centered below the fields. The second part of the form is a white box with a blue border containing a success message: 'Code generated successfully. Check your email to copy your Medical ID Code. This code will be used to identify your record any day you visit the hospital.' Below the message is an 'Exit' button.

3.5. System development

3.5.1. First development cycle

Below is the first ambience of the proposed web-based system, as exemplified in the low fidelity prototype.

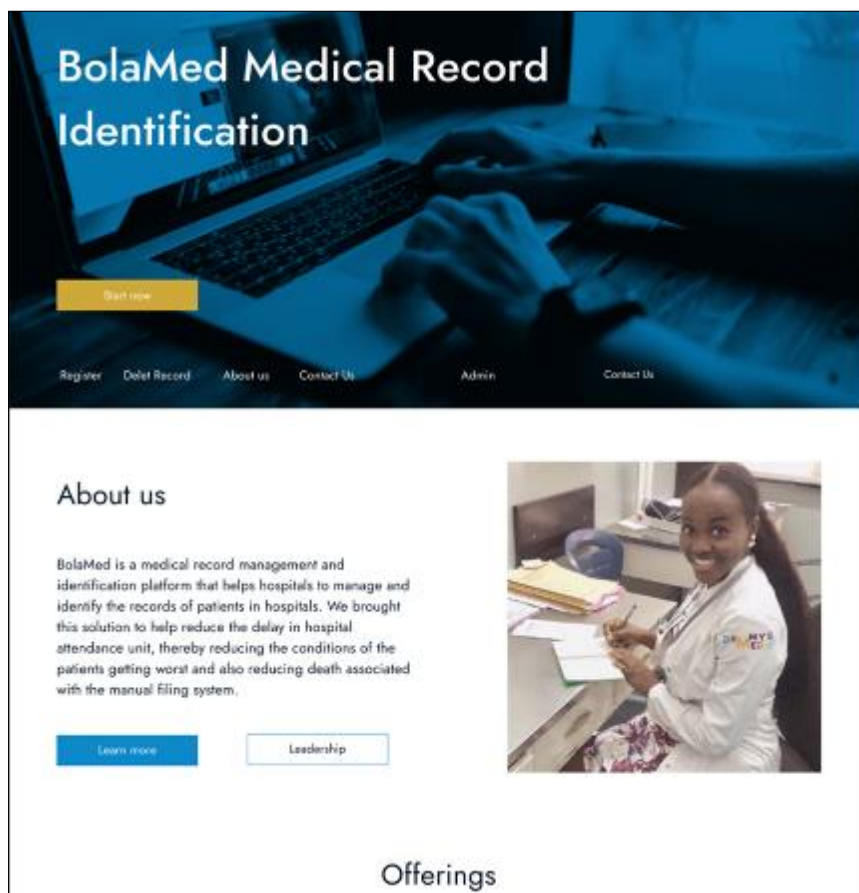


Figure 5 This is the homepage of the web-based system

3.6. Testing/user study

According to Seinfeld et al. (2020), a user study is a design approach used to evaluate how users interact with a product, system, or service. The purpose of a user study is to gather data and feedback from users to help improve the design, functionality, and user experience of the product or service (Suzuki et al., 2017).

My user study typically involved recruiting two participants who represent the target user demographic for the web-based medical record identification system. The participants were asked to perform a series of tasks while interacting with the web-based system (see interface in fig 5 above). Because of distance, I couldn't observe their behaviour and reactions. However, I got their feedback through my email (see fig.6 and fig.7).

The user study was done using the workable system thereby performing online testing of the web-based system. Questions were posted via email to the two users tested. The data collected from the user study has been analyzed to identify areas of the web-based system that are working well and areas that will be improved in the second design cycles.

3.7. Questions asked during the first user study (Via email)

- Do you find this interface easy to use?
- Do you understand the menus, icons, and language?
- Are you able to register your details as a patient? If not, where do you have trouble?
- Are you able to identify patients' records using a code generated during registration?
- What (if anything) would you like to change about this tool or add to it?

The above questions generated the below answers:

3.7.1. Respondent 1.

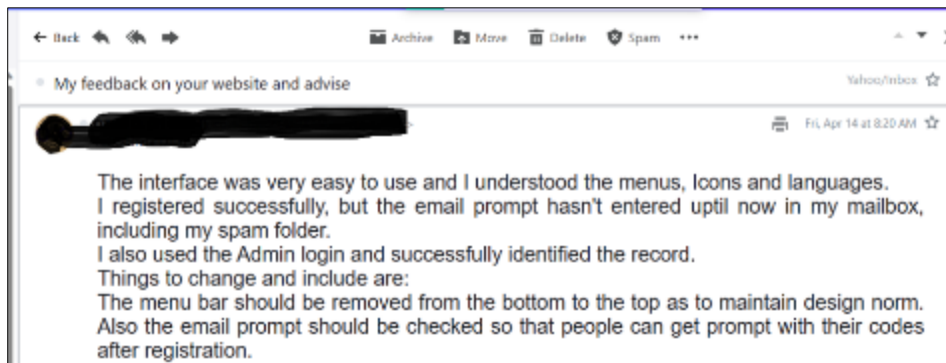


Figure 6 This is a feedback from the first user

3.7.2. Respondent 2

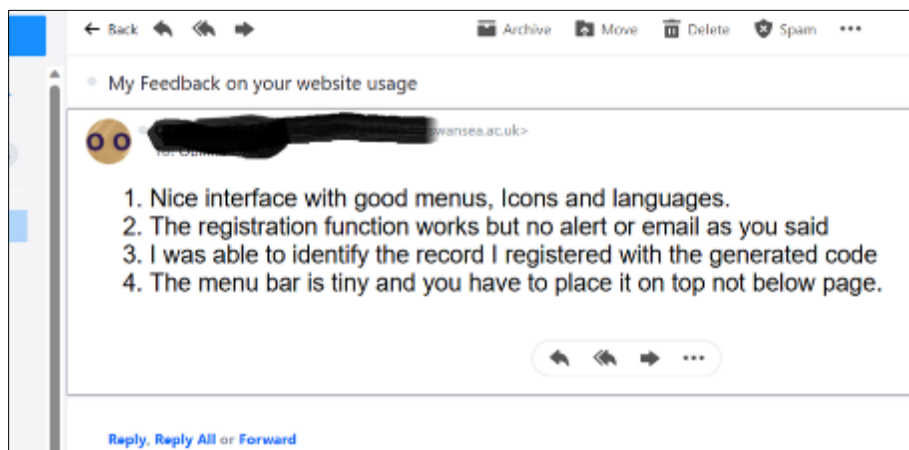


Figure 7 This is a feedback from the second user

3.8. Second development cycle

Recall that the two users had related complains of the menu bar placed at the bottom of the page, and the message prompt not delivering after registration. I went back to the design board to re-design and re-programme the system, as required in the iteration principle of agile methodology. Hence these concerns have been tackled properly in the functional system.

3.9. Web-Hosting package

The web-address chosen for the proposed system is www.bolamed.org

This address was registered and hosted in namecheap.com with a secure socket layer (ssl) which gives the site a maximum security (https). Hence, when you click on the web address, it appears with a security tag https as in <https://bolamed.org/>.

3.10. Homepage/ Dashboard

If you login to the website, the first screen you will see is the home screen (see fig 8.), which has five menus, both in the mobile and PC version. These menus are: Home, About, Contact, Admin and Register patients.

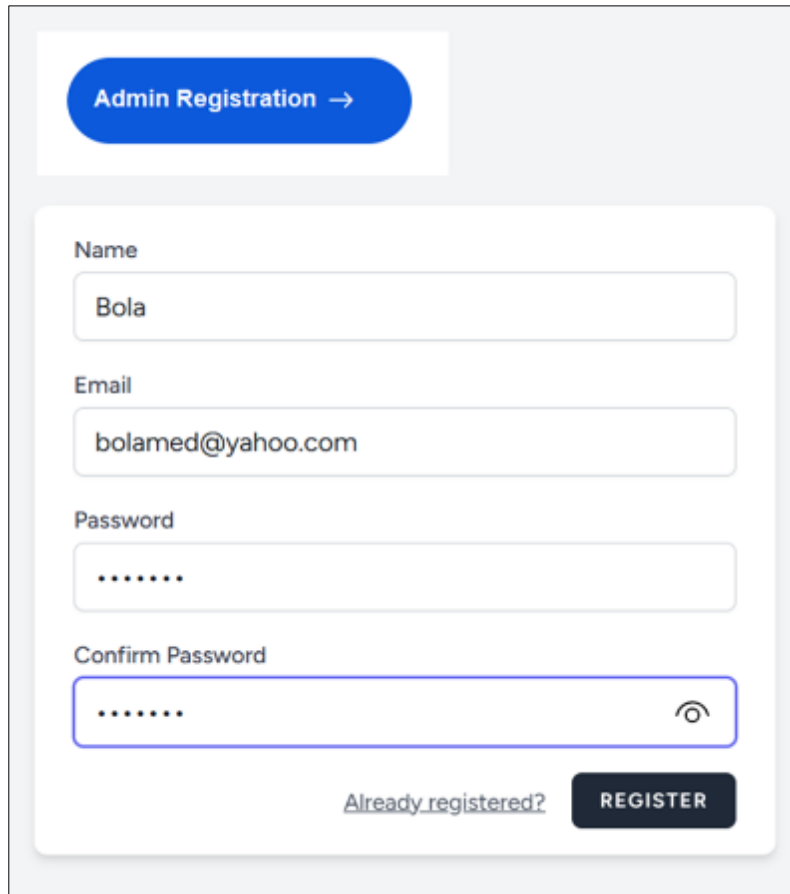


Figure 8 This the home page

The home page can also be called the dashboard through which other activities can be performed. One can contact me through the 'contact' menu or read about the system by clicking on the 'about' menu. And in each page, one can easily locate the dashboard by clicking the home page as to start afresh.

The most important menus in the home page are the 'Register patient' menu (fig.7) through which a patient gets registered, and the 'Admin' menu (fig.8), through which the medical personnel can login to identify a record.

Figure 9 This is the patient registration form



The image shows a web form for admin registration. At the top, there is a blue button labeled "Admin Registration →". Below this, the form contains four input fields: "Name" with the text "Bola", "Email" with "bolamed@yahoo.com", "Password" with six dots, and "Confirm Password" with six dots and a visibility icon. At the bottom of the form, there is a link "Already registered?" and a dark blue button labeled "REGISTER".

Figure 10 This is the admin registration form

To be an admin, the person must register with a separate link <http://bolamed.org/register>. So, only the hospital management can use this link for security reasons.

3.11. Medical Information update module

The website also has medical update module through which medical tips are shared to the website users.

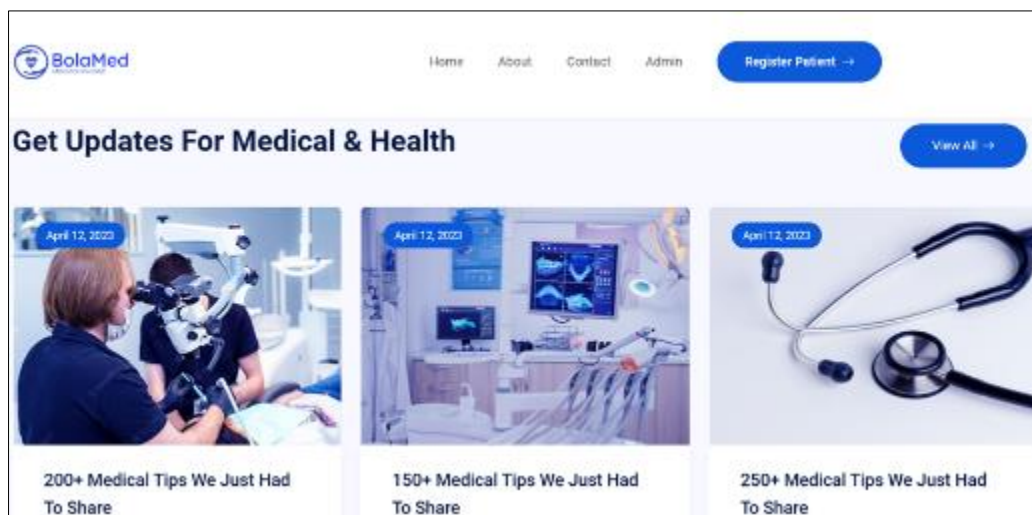


Figure 11 This is the medical information update page

3.12. Second testing/User study

The next user study was conducted in a focused group of 2 participants using zoom. The zoom video has been published in this youtube link for the purpose of this study (click link to view <https://youtu.be/45GC8VENz4g>). The two users were anonymized as their zoom cameras were off and their shown names and displayed icons were in pseudo form. However, they consented to the focus group, and approved for their recorded audio data to be shared (the signed consent form is attached in the appendix section). Same questions that were asked in the first user study was repeated, and the users were happy that their concerns were genuinely addressed, thereby confirming the functionality of the new system.

3.13. Deployment/review

These are the last phases of every agile-influenced project. Having tested the system and confirmed the functionalities and features, the system is fully ready to be deployed for use in any public hospital in Nigeria. After the deployment comes the review process, which is expected to continue till the cessation phase of the development life cycle. The web-based record identification system has been fully deployed as shown in fig 8 above, and can be accessed via <https://bolamed.org/> as earlier mentioned.

3.14. Novelty checks

The major novelty of the system is the code generated after patient's registration, which is sent to the email of the patient for easy retrieval. This same code is presented to the receptionist or medical personnel (Doctor/Pharmacist) whenever the patient visits the hospital for seamless record identification. Below are the screens of the code generation activities after patient's registration

3.15. Code generation window

Immediately the register button is clicked, the below window pops up with the patient's code.

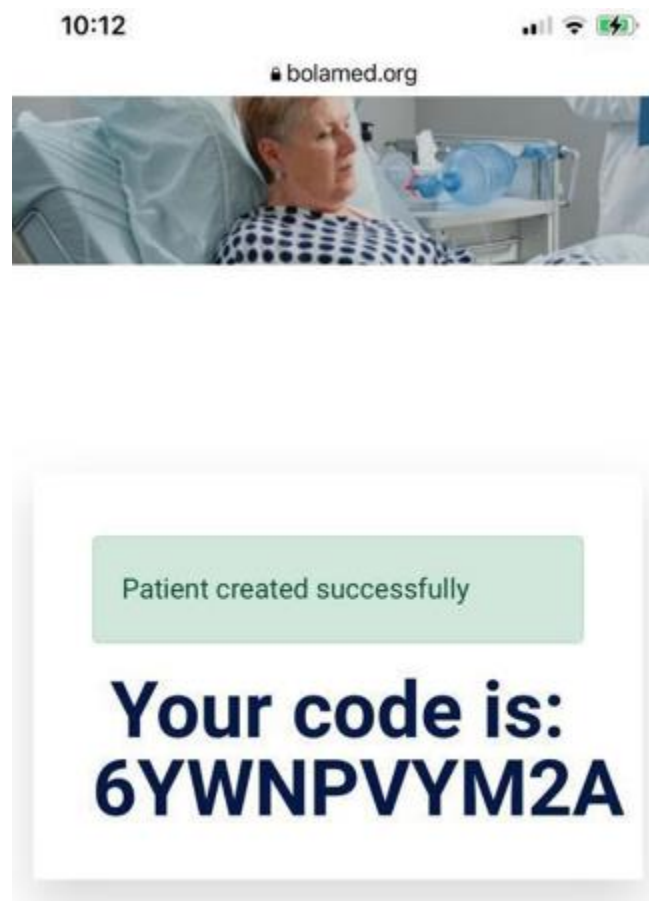


Figure 12 Code generation window

3.16. Email Notification

Once this code is generated, it is automatically sent to your email in real time as shown in figs 13 and 14 below.

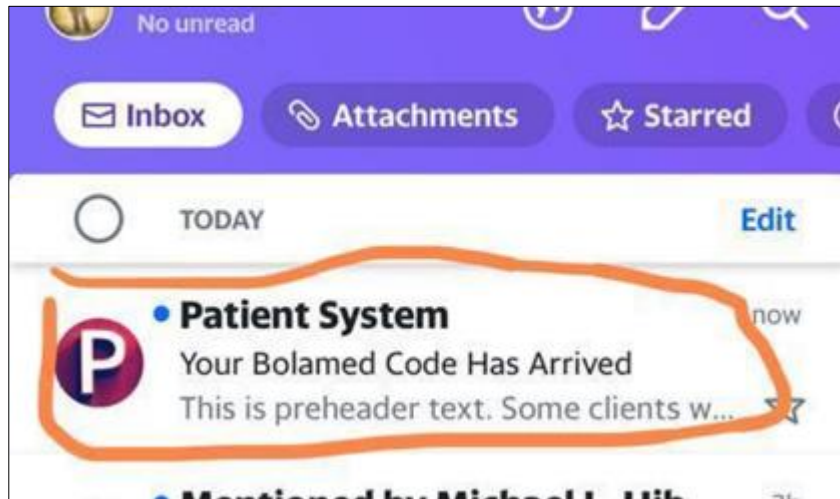


Figure 13 Inbox of a recipient

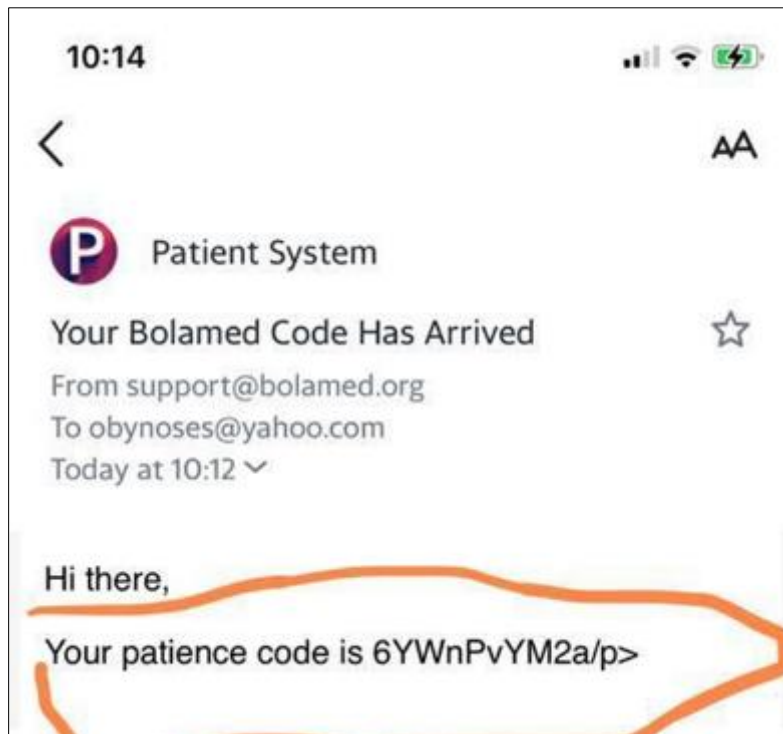


Figure 13 Generated Code when opened in an email inbox

4. Conclusion

In conclusion, we have been able to address the record identification challenges of Nigerian public hospitals by designing and implementing a web-based medical record identification system, which has the potential to revolutionize healthcare management in the country. The system would address several key challenges faced by healthcare providers, patients, and administrators in Nigeria.

Firstly, the web-based medical record identification system has enhanced the efficiency and accuracy of patient data management. By digitizing medical records and storing them in a centralized online database, healthcare professionals

now have instant access to patients' medical histories, test results, and treatment plans. This streamlined process would significantly reduce errors, eliminate duplication of tests and procedures, and improve the overall quality of care immediately after our implementation phase.

Secondly, the system is envisaged to facilitate better coordination and communication among healthcare providers. With a web-based platform, doctors, nurses, and specialists from different departments or hospitals could easily access and share patient information. This would enable more effective collaboration, faster decision-making, and ultimately, improved patient outcomes.

Furthermore, our web-based medical record identification system will be able to empower patients to take a more active role in managing their own healthcare. Patients would also have secure access to their medical records, appointment schedules, and test results, allowing them to make informed decisions about their treatment options and participate in their own care plans. This increased patient engagement would lead to better adherence to treatment regimens and improved health outcomes. Moreover, the implementation of such a system would contribute to the overall modernization of healthcare infrastructure in Nigeria. By adopting digital solutions, public hospitals would embrace technological advancements and promote a culture of innovation in healthcare delivery. This would not only enhance the quality of care but also attract investment, research collaborations, and partnerships with international healthcare organizations.

Therefore, harnessing the power of technology would streamline data management, improve communication and coordination among healthcare providers, empower patients, and contribute to the modernization of healthcare infrastructure. With careful planning, investment, and stakeholder engagement, Nigeria can pave the way for a more efficient, patient-centered, and digitally-driven healthcare system for its public hospitals.

Compliance with ethical standards

Acknowledgments

I, Otuu Obinna Ogbonna hereby declare that I authored this portfolio to highlight on the steps for computing students. Furthermore, all information used in this work are originally mine, and those gotten from other sources were genuinely referenced, taking into consideration, the dangers of plagiarism in Federal Polytechnic Oko, Anambra State Nigeria and Swansea University United Kingdom.

Therefore, the aforementioned institutions can take action against me if I am found guilty of academic misconduct in this portfolio of evidence.

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