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Methodology

Development of an Improved Web-Based Outpatient Information System

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Abstract: Outpatient information systems are used by hospitals to create, process, and record outpatient information. The problems arising from manual manipulation of foreign information systems. The study implemented a web-based outpatient information system for Good Shepherd Hospital in Enugu and inferred solutions to the current challenges by designing a web-based outpatient database system. The web-based outpatient information system was implemented using HTML, PHP and MySQL programming languages. The records were implemented on the designed outpatient management system, and the outputs were produced. The results revealed challenges faced by the traditional manual system for managing inventory. These challenges include distorted patient files, difficulty in locating a specific patient's file, difficulty connecting previous complaints with new ones due to the large volume of files, slow access to patient diagnosis history during emergency situations, lack of backup when information is lost, and difficulty producing accurate and timely reports because of difficulty collecting information from various registers. The study will improve the effectiveness and accuracy of outpatient records, drug and injection prescriptions and laboratory tests held by medical institutions.

Keywords: Outpatient, Web-Based, Information System, Hospital.

1. Introduction

Outpatient information systems are used by hospitals to create, process, and record outpatient information. This system is employed to ensure patients arrive on time for examination and treatment. It is an efficient tool for hospital administrators (Garba & Yahya, 2019). Common features of outpatient information systems include coded lists of patients' medications, problems, and allergies, electronic prescribing, tools for tracking and

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reviewing laboratory results, and systems for clinical documentation and decision support (Wright & Bates, 2017). The Outpatient Information System (OIS) records include patient identification data, histories of present and past illnesses, physical examination data, a medical problem list, medical orders, and more (Collen, 2015). The website serves as concrete evidence of the progress in information and communication technology as a tool for disseminating information. The ease of creating and using a website is one of its key strengths. Information systems exemplify the use of websites for fast and accurate information dissemination (Kurniawan & Pranoto, 2018). The outpatient register serves as a record of outpatients. The data in the outpatient directory includes admission number, patient name, age, gender, registered address, and more. The outpatient department consists of emergency rooms, files, outpatient clinics, and various clinics. Outpatient care concludes with an outpatient appointment, while inpatient care ends in their respective departments. This research also aims to design a website that can replace the manual operation of outpatient information systems. The website was created using HTML, JavaScript, and PHP to manage the database.

Research question

How do you create a new patient record?

2) How do you search for existing patient data?

3) How do you recruit them for the doctor's waiting list?

4) How do doctors remove patients they have treated from the waiting list?

5) What is the biggest problem you have encountered?

6) How do you obtain patient consent to be on the waiting list?

7) How do you diagnose patients on the waiting list?

8) What is the biggest problem you have encountered?

Answer

1) Creating a file containing patient data.

2) Obtaining the created file.

3) Listing of patient arrival times.

4) Inquiring about their health

5) Waste of time

6) Using the relationship between psychiatric inference rules and past records.

7) Remove the patient visit list from the waiting list.

8) Diagnosis would not be easier without computer-based inference rules.

2. Literature Review

HIS, or the General Hospital Information System, is a computerized system that aims to create a paperless environment in hospitals (Suleiman et al., 2021). It combines clinical and non-clinical information and is designed to manage all clinical, financial, and administrative tasks. The use of HIS has numerous benefits for healthcare professionals and patients (Ahmadi et al., 2018). The automated system is specifically intended to help manage databases of diabetic patients. In this study, we applied a distributed database system to a patient information system. This is how queries are distributed from the coordinating Informix database server to the various Informix database servers and how the coordinator reconstructs, transforms, and aggregates intermediate results from the various database servers involved in the prescription and patient information systems (Yerokun et al., 2021). The study by Youssef and Hamide (2021) showed that training end-users is critical to the successful implementation and use of a hospital information system (HIS). Without proper training, the likelihood of failure is higher. Training not only instructs individuals on how to perform specific tasks but also helps communicate organisational goals to employees. In their study, they explored the different aspects of HIS used at Mehr Hospital in Mashhad City, Iran, with the goal of ensuring that implementing the system is affordable and cost-effective. Negin et al. (2020) discovered that implementing Hospital Information Systems (HIS) can be both cost-effective and efficient in terms of generating hospital revenue.

According to Anthony et al. (2020), the decreasing costs of computer hardware, the increase in medical paperwork, and the emergence of large clinics have made it more practical to develop information systems for outpatient settings. According to Blois (2019), the specifications for an Outpatient Information System (OIS) are shaped by its intended purpose and whether it will be integrated into a larger medical information system or function independently with a doctor. Feinstein (2020) suggests organising medical records in a data catalogue based on sources and chronology of information. Every transaction in patient care should be recorded with the name of the source or service, dates and times, and a description of the service and its outcome.

Adesola et al. (2010) designed and implemented a web-based administrative information system for the National Health Insurance Scheme (NHIS) using its guidelines.

The system allows any NHIS-registered patient to visit any registered provider anywhere in the country and be assigned to a doctor. To carry out the project, we proposed a suitable architecture for the design of a model of an object-relational database for its implementation. The .NET framework has been explored for use in designing a web-based working prototype for the scheme, with ColdFusion Markup Language (CFML) using the Dreamweaver platform; the backend is Access DBMS, with ColdFusion web server acting as the middle tier. Likewise, Gimba et al. (2022) designed and implemented a Web-Based Patient Management System (PMS). The system provides the benefits of efficient tasks, improved administration and control, patient care, and improved effectiveness. The paper describes knowledge of a web-based platform that facilitates many medical/patient processes online using web and networking technology, which can be very important in implementing the functionality of online patient management. The system was designed in C# as the front-end software, which is an object-oriented programming language, and has connectivity with the back-end software in MySQL.

3. Methodology

Outpatient System Specification

The use case diagrams in Figures 1 to 4 represent the system's requirements for the most important hospital units: receptionists, nurses, doctors, and administrators.

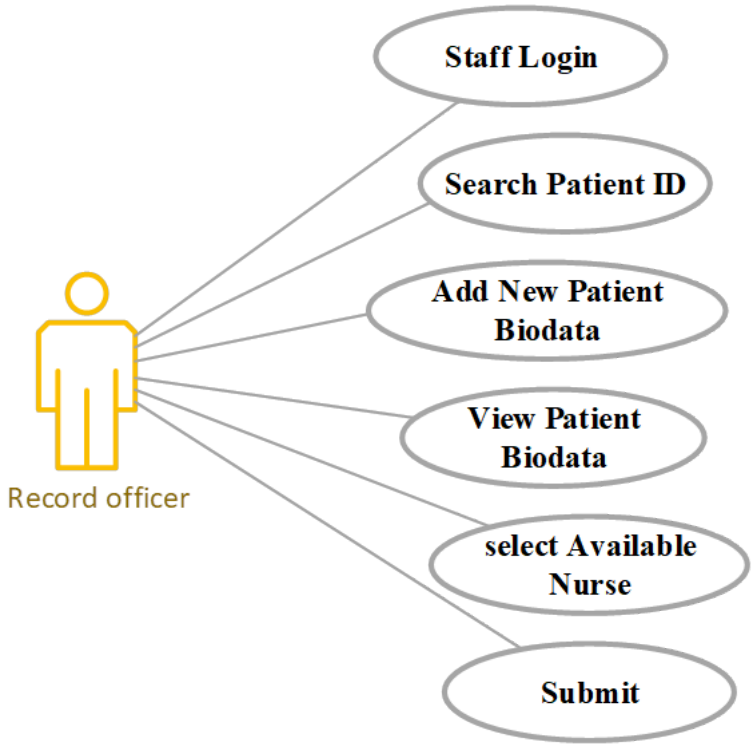


Figure 1: Record Requirement

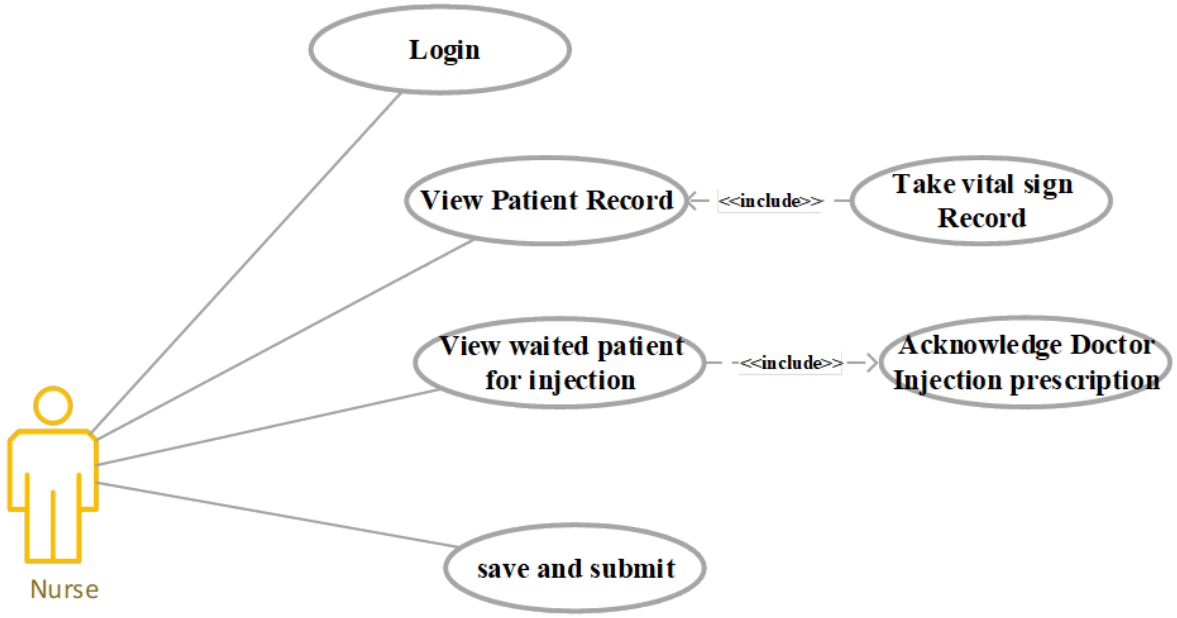


Figure 2: Nurse Requirement

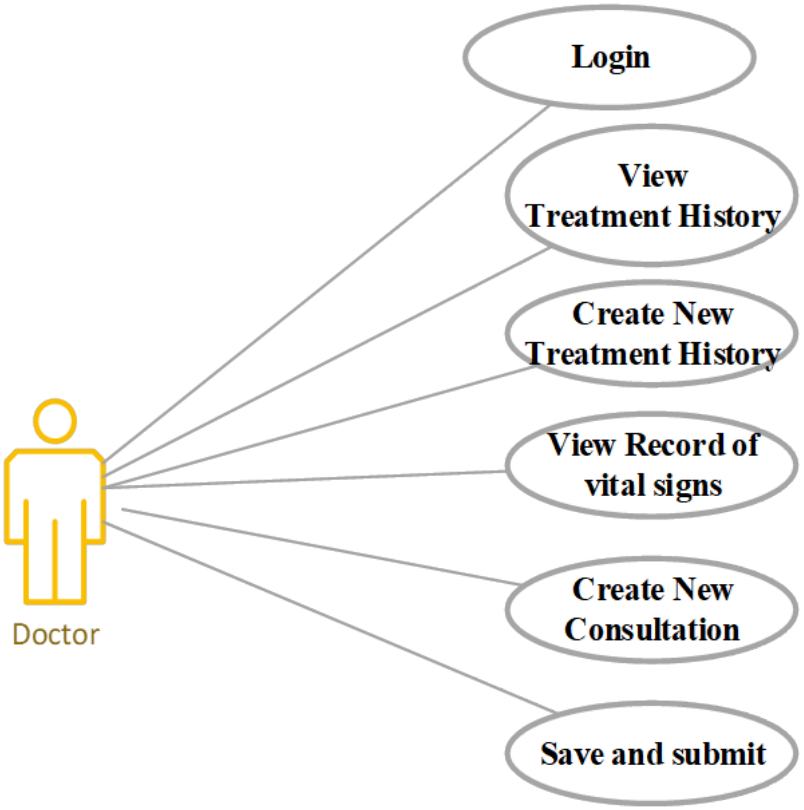


Figure 3: Doctor Requirement

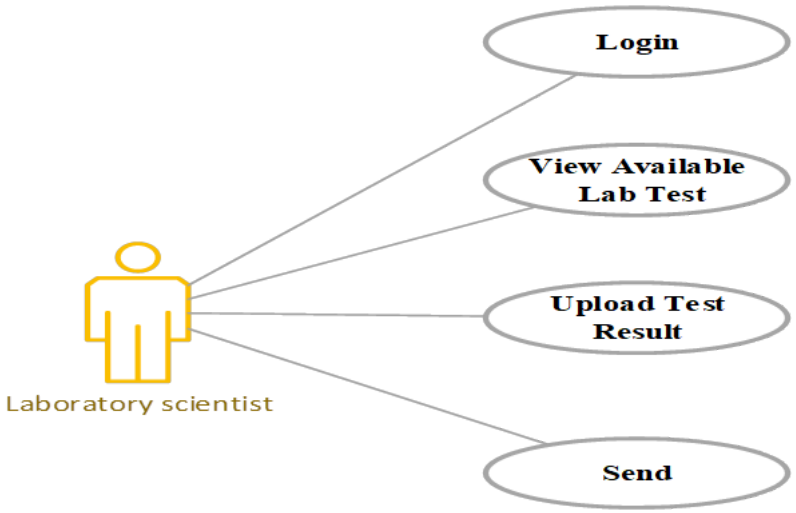


Figure 4: Laboratory Scientist Requirement

Data collection

This was done among researchers, nurses, physicians, laboratory scientists, and other on-duty medical staff at the hospitals involved in the study. Reliable data were collected based on questions that researchers asked the staff. The manuals and reports used by laboratory workers and scientists were examined and yielded substantial information about the system in question. Several required and available evaluation forms were assessed, including lab forms, test results, and so on. These forms are useful in designing the new system.

Web-based Application of Outpatient Information System

The proposed system, known as a web-based outpatient information system, offers convenient online storage, updates, and retrieval capabilities. By utilising this system, healthcare professionals such as doctors, nurses, and surgical staff can benefit from reduced paperwork and streamlined information access.

This system utilises open-source technologies such as MySQL, HTML, and PHP for efficient data handling. As open-source technologies, these tools are cost-effective as they can be easily downloaded from the internet, and MySQL serves as the preferred database management system.

The Proposed Web-based OIS System

a) The biodata retrieval module facilitates swift retrieval of patient records through the use of identification numbers, eliminating the need for manual retrieval and minimising the time and effort required to access these records.

b) The drug prescription module enables physicians to prescribe medication to patients, which is then automatically linked to the patient's profile. This allows for easy access to information about previously prescribed medications and illnesses for both the current and any future treating physicians.

c) The laboratory request and reporting module is a feature that allows for proper documentation of lab tests and results. It is utilised by doctors to request tests to be performed on patients. After the tests are completed, the laboratory scientist sends the results back to the physician and stores them electronically within the patient's profile.

d) The injection recipe module is a feature that enables doctors to prescribe, document, and transfer injections to available nurses. The injections are administered to the patient by a nurse, and the treatment is then confirmed.

e) The record of vital signs module is a feature that allows nurses to record patients' vital signs, such as weight, height, temperature, pulse rate, and blood pressure measurements.

f) New consultation module: this allows the medical doctor to create a new consultation by referring the patient to a specialist or a consultant in the same or a different area of specialisation. It can also be used to create another appointment date for the patient to come back for check-ups.

4. Outpatient Implementation

Modules of the proposed software include staff login, staff registration form, laboratory test, medical doctor, nurse, record unit, laboratory unit, search, new user, patient login, etc. Each module of the implementation is explained below.

Figure 4 depicts the staff registration form. Each member of staff needs to register to access their login page with basic information such as first name, last name, department (staff will select their respective department using a drop-down menu), email address, password, profile picture, address, and phone number.

Figure 5 shows the staff sign-in form, where the staff log in to perform their respective tasks using their email addresses and passwords created from the staff registration form.

Figure 6 illustrates the staff dashboard where the list of patient biodata submitted and other necessary information can be viewed.

Figure 7: The record officer is responsible for adding new patient biodata and submitting it to the available nurse. The available nurse will take records of vital signs such as weight, blood pressure, and pulse rate, and submit them to the doctor on duty.

Figure 8 shows the doctor creating a new treatment history for the patient, where the doctor writes and records descriptions, drug prescriptions, symptoms, injection prescriptions, and documents prescribed laboratory tests, then submits them to the respective staff to carry out the tasks.

Figure 9 illustrates the creation of a new consultation for a patient who needs to be referred to a specialist consultant. The information includes the consultant's referred name, appointment date, department to which the patient was referred, patient ID, and appointment description.

Figure 10 depicts the laboratory test results, where the laboratory scientist uploads the test results back to the doctor. The scientist uploads the file, selects the category of test that was carried out on the patient from the drop-down menu, and then comments and types recommendations on the test results.

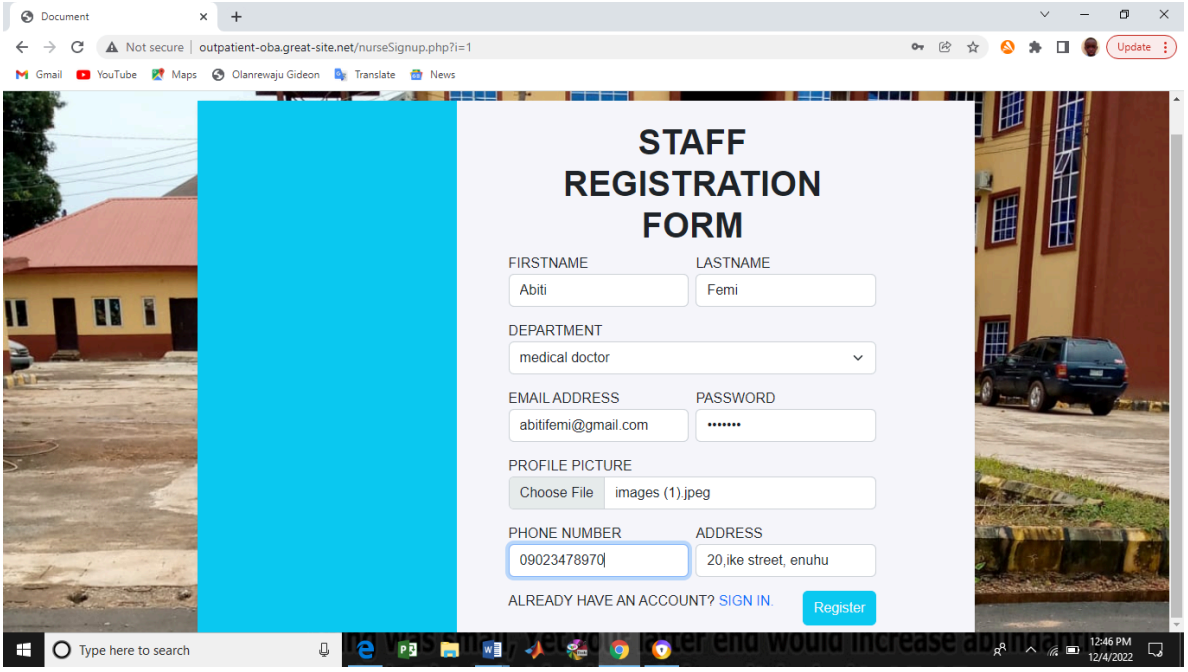


Figure 4: Staff Registration Form

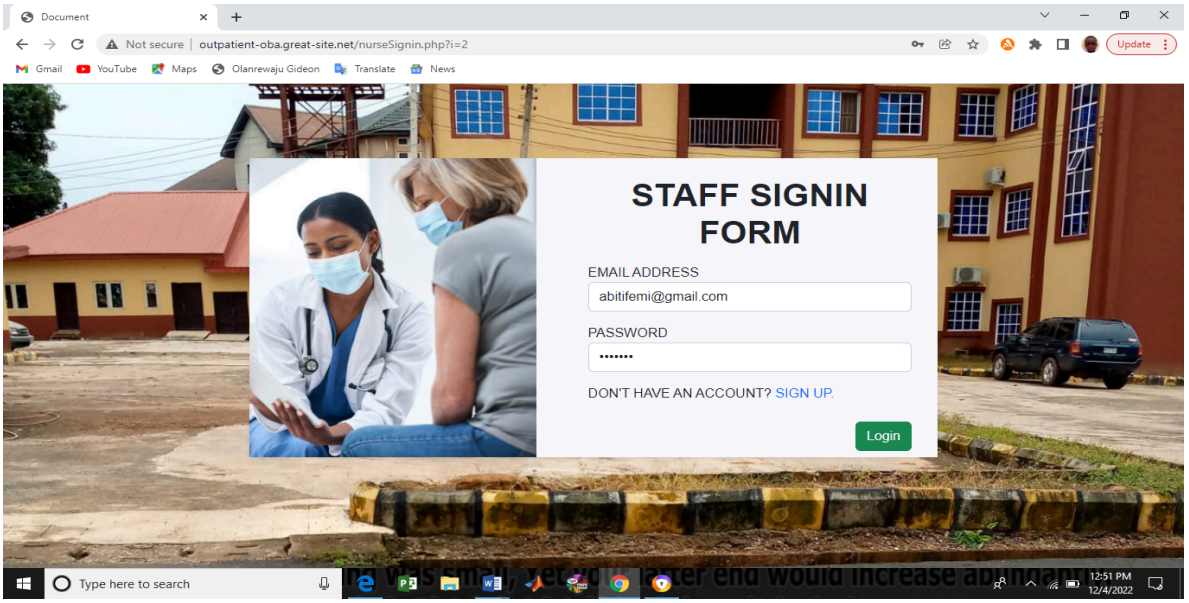


Figure 5: Staff Sign-in Form

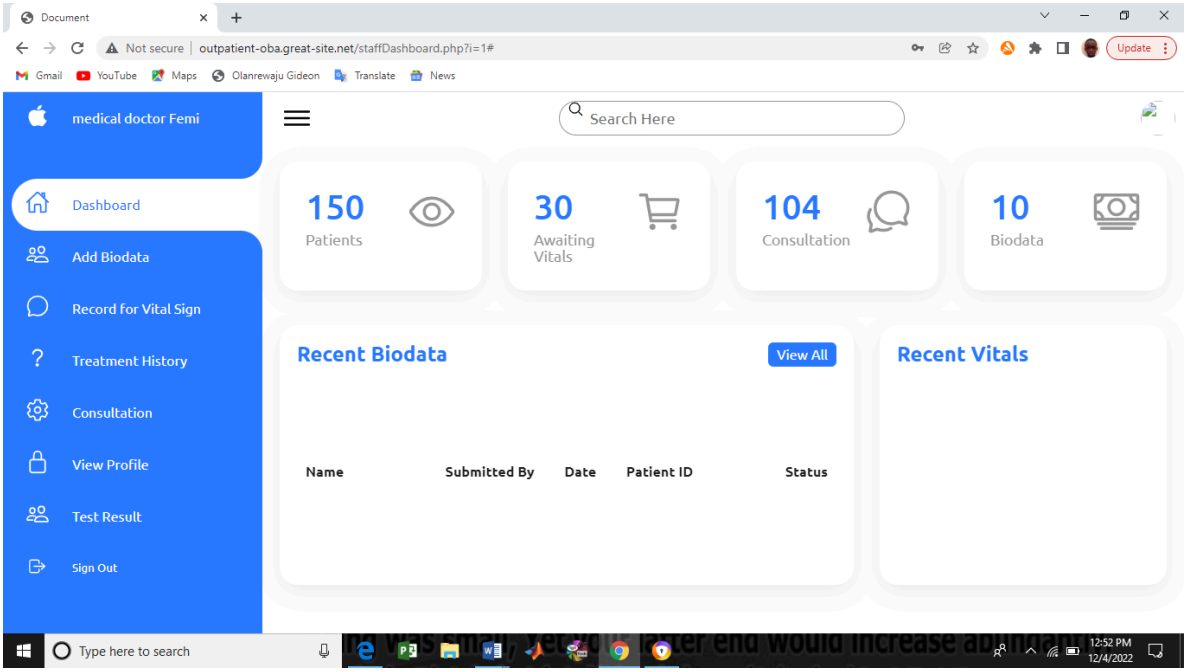


Figure 6: Staff Dashboard

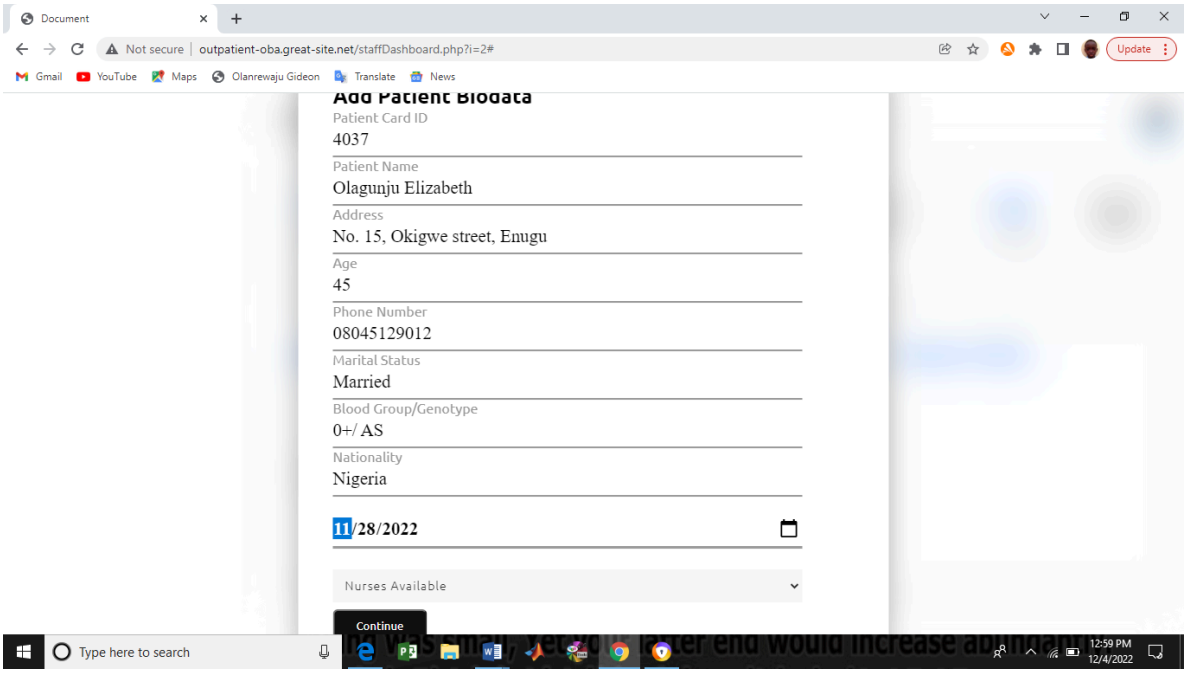


Figure 7: Patient Biodata Form

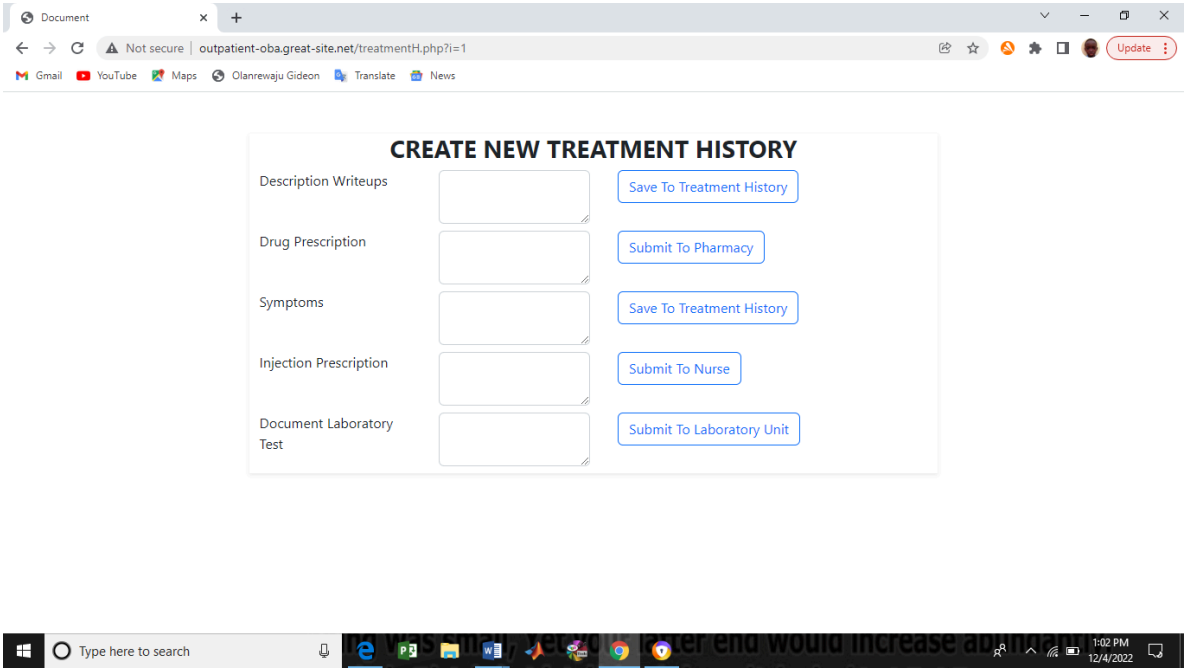


Figure 8: Treatment History

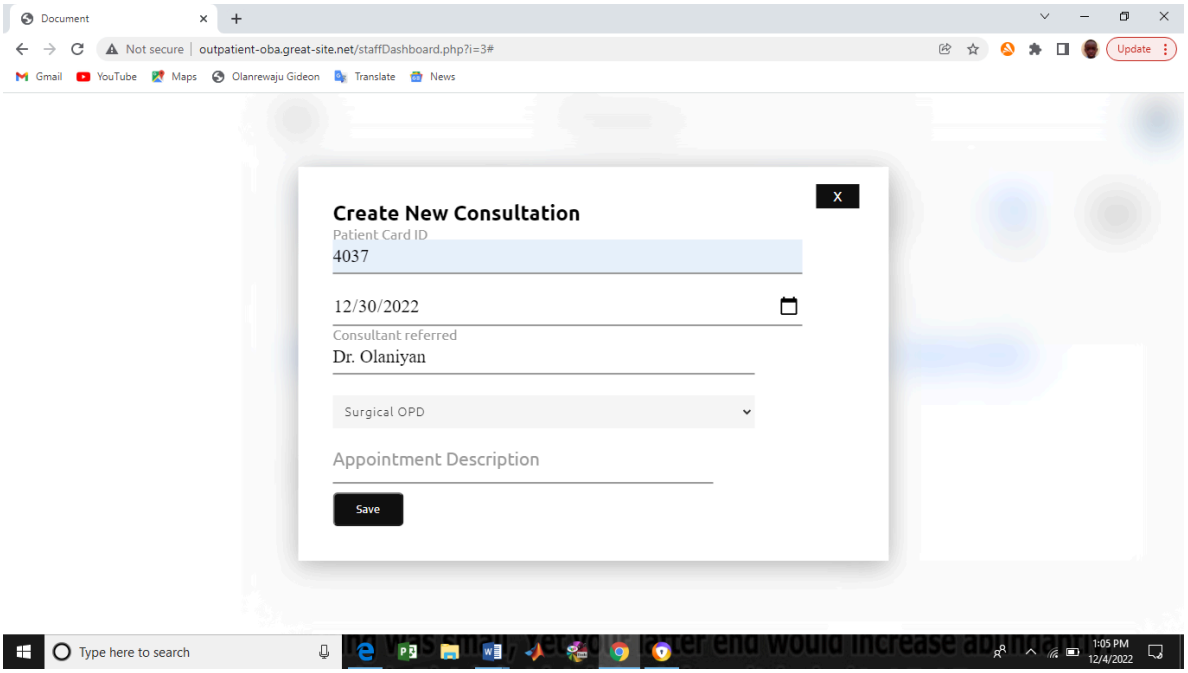
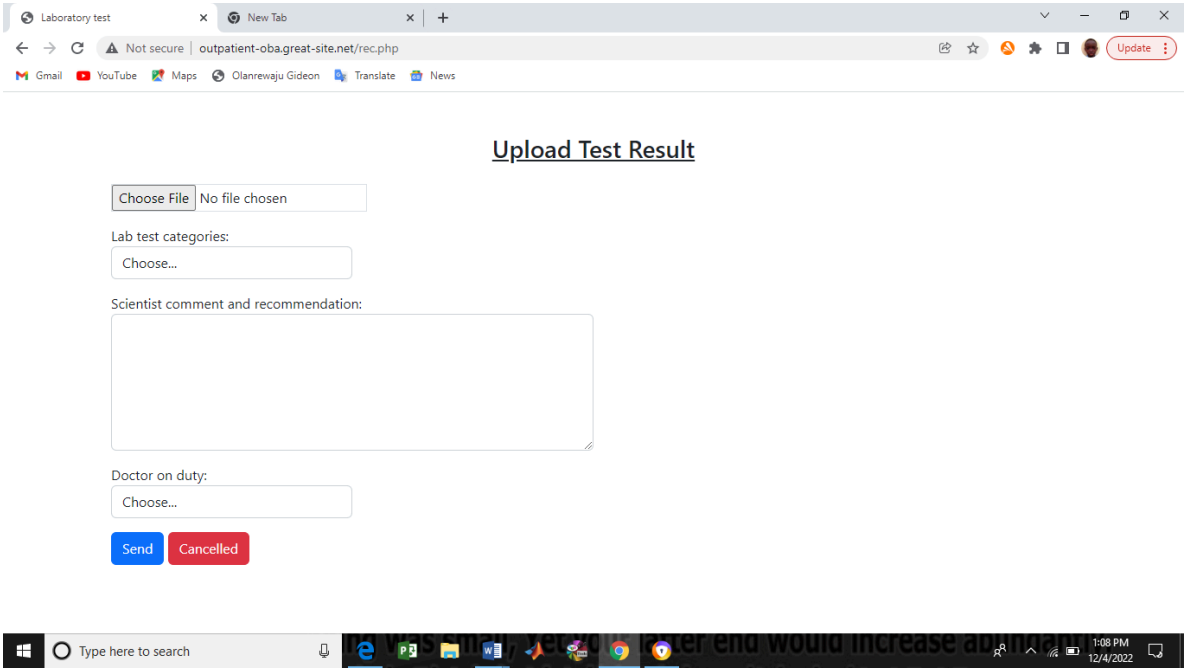


Figure 9: New Consultation



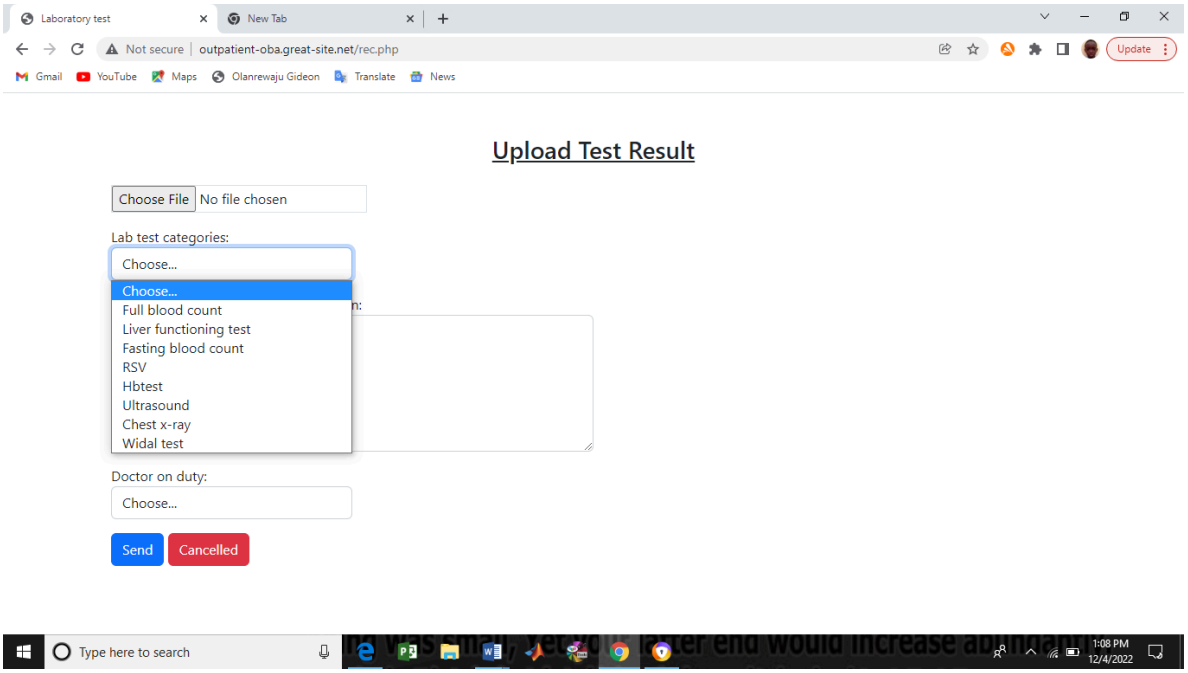


Figure 10: Laboratory Test

The web-based outpatient information system was successfully designed and implemented using HTML and PHP. The system includes features for patient registration, appointment scheduling, medical history management, and prescription management. It also includes a secure login for healthcare service providers. The design and implementation of a web-based outpatient information system using HTML and PHP have several advantages. The system can be accessed remotely from any location with an internet connection, providing convenience for patients and healthcare providers. Additionally, the system allows for real-time updates to patient information, which can improve the quality of care provided.

The system includes a patient registration module that collects basic demographic information, contact details, and medical history. The registration module is designed to be user-friendly and easy to navigate. The appointment scheduling module allows patients to schedule appointments online, and healthcare providers can view and manage appointments in real time.

The medical history management module allows healthcare providers to view and update patients' medical histories, including past illnesses, medications, allergies, and test results. This information can be crucial in providing appropriate medical care and treatment. The prescription management module enables healthcare providers to prescribe medication and update medication information for their patients.

5. Conclusion

A web-based ambulatory information system has eliminated manual system delays, the unavailability of data backups, and the security of patient information. The system was developed using Good Shepherd Specialty Hospital as a case study and can be adopted by any healthcare facility. The use of a web-based outpatient information management system will undeniably improve the effectiveness and accuracy of outpatient records, drug and injection prescriptions, and laboratory tests held by medical institutions.

RECOMMENDATIONS

Based on this study, two main recommendations have been identified to enhance the design and implementation of a secure and efficient web-based outpatient information system:

1. To improve security and ensure accurate retrieval of patient biodata and medical history, it is recommended that outpatient fingerprints be integrated into the database. This biometric authentication will enhance the security of the system by providing a reliable method for identifying patients.

2. Extending the system to allow patients to securely access their medical information via smartphones is essential. Implementing QR code scanning for this purpose will enhance transparency and convenience. Patients will be able to view their medical records and history easily, promoting better patient engagement and satisfaction. Finally, the main limitations of this study were time, financial constraints, and the poor response of some physicians who feared computers would take over medical practice, thereby risking premature job loss. For this reason, researchers recommend mandatory computer science training for all medical professionals to keep up with current trends in information technology.

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