E-Konsulta: Clinic Medical Record Management System with Online Follow-Up Through Google Meet

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Abstract

An operational clinic is essential in educational institutions to support the health and well-being of students and staff, directly enhancing productivity and academic achievement. However, many clinics still rely on outdated, paper-based systems, leading to inefficiencies, delays, and errors. Modernizing healthcare through digital solutions can improve efficiency, accuracy, and accessibility. This study proposed a system application to address common issues by digitizing medical records, automating workflows, and enabling online consultations. The platform enhances the accuracy and accessibility of patient data while streamlining administrative tasks, benefiting all stakeholders. Extensive testing revealed excellent performance, with a 100% pass rate in most functional areas and high scores in non-functional aspects, including reliability (97.14%), security (95.71%), and user experience (98.57%). Minor areas for improvement were noted in certain functionalities (92.90%) and accessibility (90%), underscoring the importance of continuous optimization to enhance inclusivity and usability. Future enhancements could include developing a mobile application for improved accessibility, enabling users to access records, book appointments, and participate in consultations on their devices. Advanced features such as enhanced online follow-up consultations, automated reminders, and health monitoring tools could further improve healthcare delivery. Integrating real-time analytics or telehealth capabilities may also provide broader support for patient care. These recommendations highlight the potential for the system to evolve, offering a more efficient, inclusive, and responsive approach to healthcare within educational environments.

Keywords: Health Management System, Medical Record, Online Follow-Up, Google Meet.

I.   Introduction

An operational clinic is essential in educational institutions to support the health and well-being of students and staff, directly enhancing productivity and academic achievement. However, many clinics still rely on outdated, paper-based systems, leading to inefficiencies, delays, and errors. Modernizing healthcare through digital solutions can improve efficiency, accuracy, and accessibility. A digital healthcare platform addresses these challenges by streamlining workflows, managing patient records, tracking and inventory, and ensuring accurate, confidential, and timely healthcare services.

Research shows that international perspectives highlight the importance of accessible healthcare in schools, with studies indicating that early detection of health issues significantly enhances overall well-being and academic success [1]. Research has also shown that adopting digital solutions in healthcare can improve service delivery, reduce administrative burdens, and ensure more effective health interventions [2]. Additionally, innovative tools such as telehealth and automated health systems have been associated with increased patient satisfaction and operational efficiency [3]. This project

reflects a commitment to leveraging advanced technologies to overcome logistical barriers, enhance patient care, and foster a healthier, more productive educational environment. An international study emphasizes the importance of accessible healthcare within schools to improve outcomes and enhance the capabilities of both students and staff. This perspective is supported by the World Health Organization (WHO), which recognizes that such an approach is highly effective in promoting the overall well- being of students in the school environment [4]. The project we developed turned out to be an invaluable tool for addressing the challenges the school clinic staff faced. Prior to implementation, managing patient records, appointments, and medical supplies often created significant inefficiencies and stress.

The study is sourced by a diverse range of sources, ultimately leading to developing a system that offers a novel and innovative approach for our clients to manage their resources and patients more effectively. The design of this system is grounded in the principles of electronic health records (EHRs), which are recognized for their ability to reduce documentation errors, enhance decision-making, and facilitate efficient health data management [5].

Addressing this systematic problem is truly innovative, essential, and beneficial for equitable access to healthcare for students and employees [2]. Thus, by adapting an approach like this it could be a mean to overcome logistics challenges in which everyone in the school premises can benefit into this high-quality healthcare service. As shown in the Figure 1 below is our Product Perspective in which it illustrates and highlights the seamless integration of the business logic of the school clinic which rendered our approach in addressing the institutes challenges.
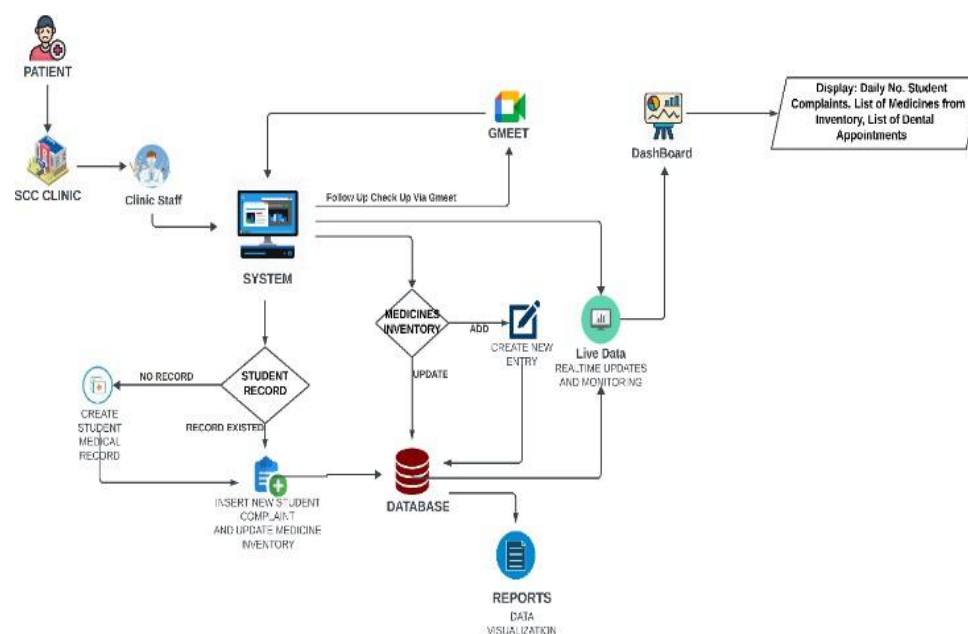

Figure 1. Product Perspective

To further expand our vision for this study, our project is not just aiming for the proper organization of the seamless, paperless transaction of the clinic staff; we, as a team, developed a system in which online consultation and follow- up can be reached with the help of Google Meet. As shown in the Figure 1 the transaction between the system and the Google Meet is made through by the help of an API in which it allows us to generate the code and link and redirect the clinic user by this case e.g. Nurse or Dentist to the browser to finally have a proper setup of their scheduled online follow-up consultation.

II. Methods

The research methods employed in developing our project were based on the Waterfall Development Model [6] [7]. This model provided a structured and sequential approach, allowing us to define and complete each phase of the development process systematically. Additionally, the project was developed using the C# programming language, which enabled us to work in a familiar and efficient environment.

While the foundation of the study is the Waterfall model, we incorporated elements of both iterative and incremental approaches. This combination allowed us to adapt to client requirements more effectively and refine the system progressively. By leveraging these approaches, we ensured the delivery of a high quality and efficient software product that meets the client's needs.

To further Support our study, we used a descriptive approach on our research method in which it enables us to utilize our survey questionnaire as a tool in gathering important data to further access the improvement, updates and functionalities that is needed to be implemented on our system. An addition to that, according to a study and the reason we implemented a descriptive method on our study its because it allows us researchers to describe the characteristic of certain population to be studied further and be able to narrow our scope for a precise delivery of the satisfaction towards our own client [8]. The Development of the said project consist of the following stages that are based on the Waterfall Model:

1. Requirements Gathering

During this phase, we gathered important data, such as the clinic's Business Logic in which we come up with the final product perspective on the Figure 1 and necessary Data specifically related to clients' needs. Identifying the project's objective and requirements is very crucial to ensure that the clarity and alignment of the system are aligned with the client's expectations.

2. System Design

Right After Gathering the Requirements, We, the Researchers, created a detailed design for the system, in which we were able to come up with our studied Use Case Diagram Below on the Figure 2 It illustrates the whole concept of the system, breaking down and aligning with the business logic of our clients' needs. We also implemented the Google Meet Code for online follow-up consultations.
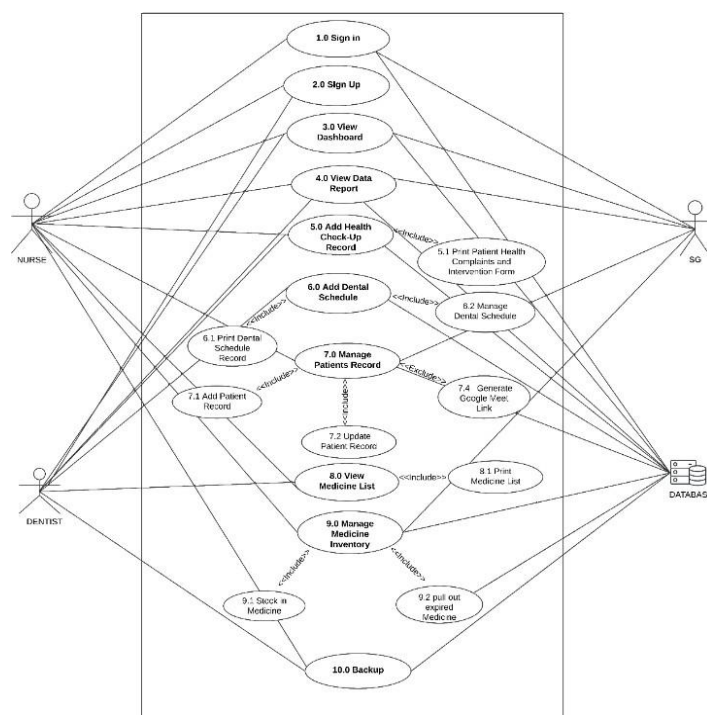

Figure 2: Use Case Diagram

3. Implementation

The Development of the system is developed using the C# Programming Language, which also follows the concept of our client and follows the standard Object-Oriented Program and UMLs to have the standard result [7],[10],[11]. We Researchers use other tools such as Figma, Canva, and Visual Studio as an environment for developing the system and enhancing the system's beautification and functionality. The Development also included MySQL as our Database. Since our system mainly focuses on offline and local data storage, it is recommended that we use MySQL since it is more familiar to us researchers and will be able to manage the system's creation. Each module of the system was coded according to the design specifications, which can be referred to as the Figure 3 below.
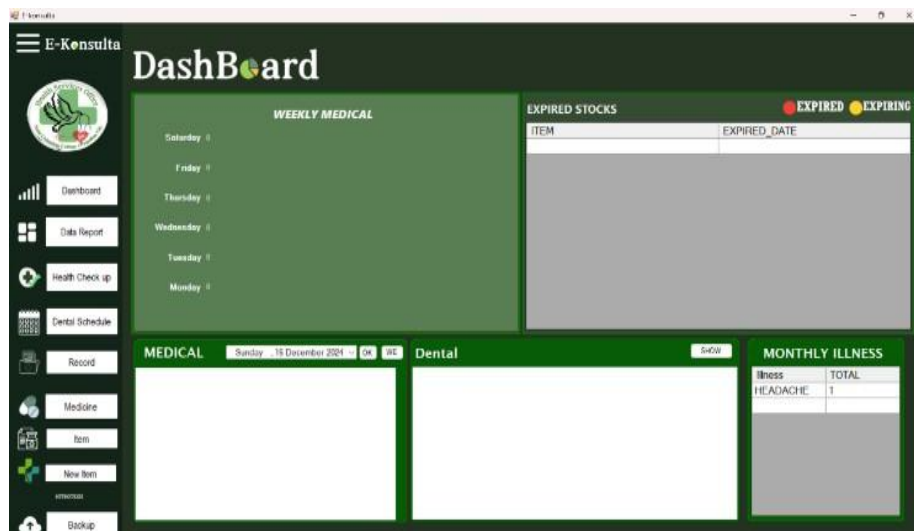

Figure 3: Module Interface (Dashboard)

4. Testing

At this Juncture, We researchers proceed with the testing of the system with rigorous methods such as aligning the test survey and questionnaire with the ISO standard 25010 and being able to gather information for the improvements of both the functional and non-functional requirements of the system [9],12]. The study also included Unit Testing, which helps us researchers to identify the bugs and lines of code that need to be refactored. Since we are using C#, we conducted the unit test is based on Nunit Testing, in which we only identify the important modules that are most likely to be used throughout the system.

Below on the Error! Reference source not found. These are the Modules of our system that have been tested. We likely chose these modules to be tested because Nunit is only available with methods. Since our system is more likely focused on the UI and Databases, we chose these modules because they only have the important methods that need to be used.

Table 1: Nunit Testing Final Result

Category	Test Name	Duration
DashboardTest	expired_WhenCalled_DataGridView4IsPopulatedWithEx pectedData	3 Second
	sched_WhenException_MessageBoxShowsInvalidLogin	19 Millisecond
	viewsS_WhenException_MessageBoxShowsInvalidLogin	6 Millisecond
	views_WhenException_MessageBoxShowsInvalidLogin	5 Millisecond
	xtodayspatients_WhenException_MessageBoxShowsInval idLogin	6 Millisecond

	xtxodaysschedule_WhenCalled_SetsLabelTextToCount	4 Millisecond
	xtxodaysschedule_WhenException_MessageBoxShowsIn validLogin	4 second
	xxtodayspatients_WhenException_MessageBoxShowsInv alidLogin	16 Millisecond
	xxweekpatients_WhenException_MessageBoxShowsInval idLogin	10 Millisecond
Form1Tests	Auto6_ShouldPopulateAutoCompleteCollection_WhenD atabaseHasValues	3 second
	Button4_Click_ShouldNotShowMessage_WhenAllFields AreFilled	899 Millisecond
	Button4_Click_ShouldShowMessage_WhenFieldsAreEm pty	762 Millisecond
	Button4_Click_ShouldShowMessage_WhenOneFieldIsFi lled	6 second
LoginTest	Login_ShouldDisplaySuccessMessage_WhenValidCreden tialsAreEntered	47 Millisecond

The Table above shows the total value of how fast each module will be able to respond to each test that it is required to. This information helps researchers decide how to refactor the codes and functionality that need to be improved or changed [13].

5. Deployment

Right After the Testing Method, we proceeded with the Deployment of the system. The system was deployed successfully with the client's permission, and now the system is in its working phase. This phase involves setting up the proper environment of the system and the connectivity of the system on each personal computer in which it involves networking via wireless connectivity. We researchers ensure that the system itself is working properly and to satisfy our client's expectations [14].

6. Maintainance

After deployment, we continued to provide ongoing support and maintenance to address any issues and incorporate necessary updates based on the client's evolving needs [15].

III. Results and Discussions

Our Study shows that the system that we developed shows an excellent performance on the testing that we conducted by giving questionnaires and surveys. Achieving 100% pass rate in the majority of its functional areas, such as managing the patients record, appointment scheduling and inventory tracking. These results highlight the system's effectiveness in meeting the clinic's core objectives, ensuring that essential tasks are streamlined and performed accurately. In terms of non-functional aspects, the system achieved impressive scores in key areas: reliability (97.14%), security (95.71%), and user experience (98.57%). These high scores emphasize the system's robustness and ability to provide a secure, stable, and intuitive environment for both healthcare providers and patients. However, some minor areas for improvement were identified. Specific functionalities scored 92.90%, and accessibility was rated at 90%. As shown in the Figure 4 and Figure 5 below is the total result summary of the functional and non-functional test result:
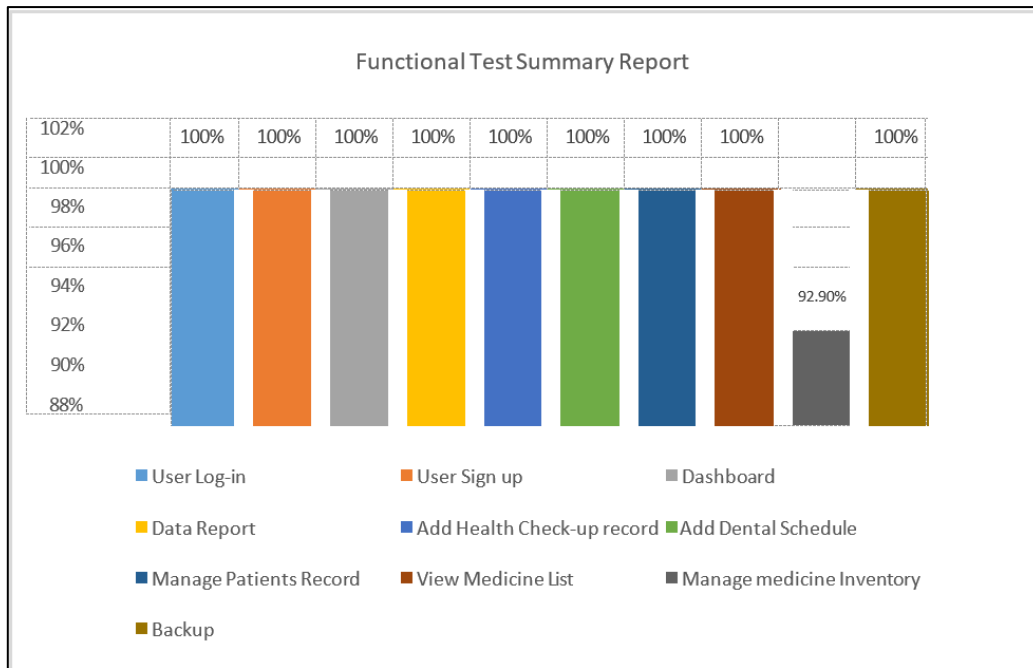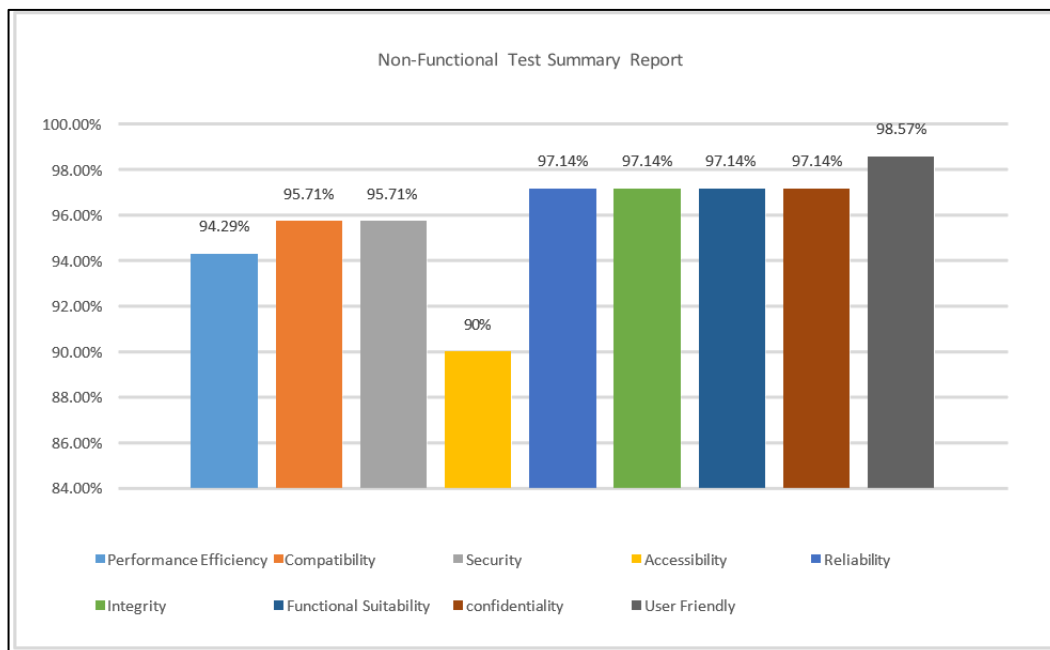
Figure 4. Functional Test Summary

Figure 5. Non-Functional Test Summary

On the other hand, the test result of the ISO standard 25010 has also shown a great positive outcome, with improvements in Functional Suitability (96.14% to 96.47%), Reliability (93.84% to 95.71%), and Security (93.14% to 98.94%). Attributes such as Compatibility and Interaction Capability remained consistent, while slight declines were observed in Performance Efficiency (92.29% to 91.76%) and Safety (91.58% to 91.11%). Overall, the results highlight the system's high compliance with ISO standards, showcasing its strong functionality, security, and reliability.

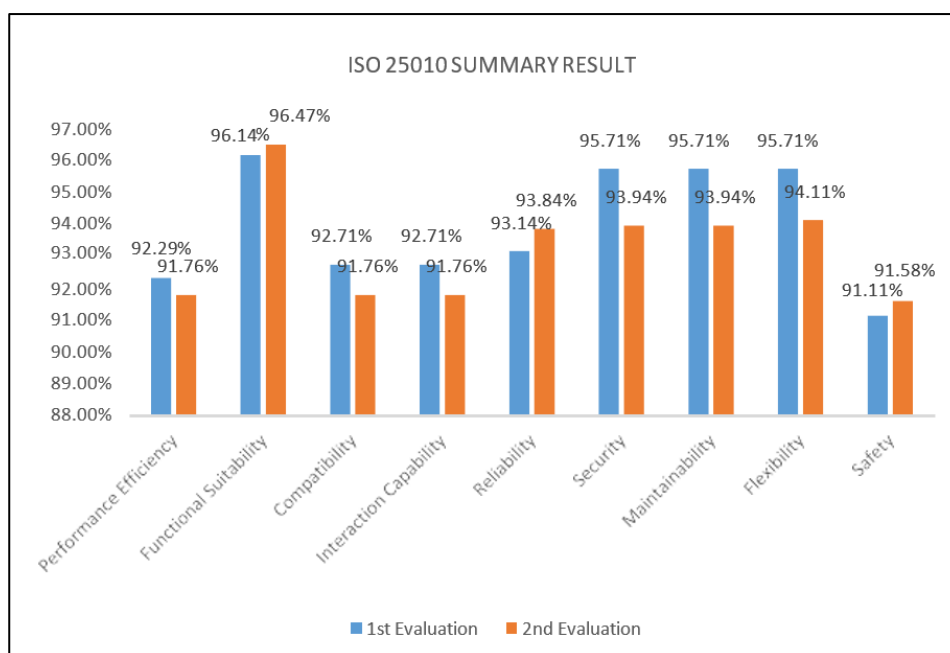The Figure 6 Below is the ISO standard 25010 result summary:

Figure 6. ISO 25010 Summary Result

IV. Conclusions

In Conclusion, our study and the results of our testing and research shows that the system that we developed has greatly impacted the school clinic workflow, in which it allows the staff's ability to efficiently manage the records of the patients, inventory, the health of the school premises. By this we can also conclude that the system not only helped the school clinic by managing the records, it also showed that by adding a feature such as integrating Google Meet in the system, leveraging their work progress in much efficient and precise manner.

Based on the feedback of our client, panels, and chairperson the following enhancements and recommendations are to be followed:

1. Automated Medical Certificates: Enable the system to generate medical certificates based on patient consultations
2. Appointment Reminders: Implement automated reminders via email to ensure patients are notified of upcoming consultations.
3. Improve security measures and system efficiency.
4. Possibility of Mobile Application.
5. Seamless integration of Google Meet
6. Archiving or Deletion of past medical record.

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