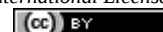


Development of a Web-Based Expert System for Cancer and GERD Diagnosis

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ABSTRACT

Cancer and Gastroesophageal Reflux Disease (GERD) are serious health problems whose early detection is often hampered by limited access and awareness. This research aims to develop a website-based expert system as a solution to help the public perform an initial diagnosis of cancer and GERD independently. The system development methodology includes a requirements analysis phase, data flow design using DFD and ERD, and implementation using Visual Studio Code with programming languages such as Python and JavaScript, along with a MySQL database. The result of this research is a functional web-based expert system equipped with various features, including user registration, a structured diagnostic questionnaire for cancer and GERD, a diagnosis result page complete with recommendations, and a statistics module for data visualization. This system successfully provides an easily accessible platform for initial diagnosis, despite having limitations related to accuracy, which depends on user input. In conclusion, this expert system has the potential to be an effective initial screening tool for increasing awareness and accelerating the management of these two diseases.

1. Introduction

Cancer and Gastroesophageal Reflux Disease (GERD) are major health problems. Cancer often goes undetected until an advanced stage due to nonspecific early symptoms, making it a leading cause of global death. Meanwhile, GERD, a condition characterized by acid reflux, can lead to serious complications if left untreated. Acid reflux disease is caused by increased acid in the esophagus or stomach lining [1], [2]. Acid reflux disease is a symptom of gastritis, which is caused by, among other things, damage, disease, and decay of the gastric mucosa. Therefore, treatment of acid reflux disease requires a specialist doctor [3], [4]. Before acid reflux disease and GERD develop, there is a predisposition to peptic ulcers. Peptic ulcers, medically known as gastritis, are a condition of discomfort and irritation caused by increased levels of stomach acid [5]. Early detection of these two conditions is often hampered by low public awareness and limited access to healthcare services in many regions. Therefore, the use of a web-based expert system offers a solution to help people recognize symptoms and make an early diagnosis independently.

With advances in information technology, systems that can mimic the decision-making process of an expert, known as expert systems, have also developed [6]. This technology serves as a medium for presenting information and enhancing the performance of human knowledge. Expert systems, a branch of artificial intelligence, are designed to solve complex problems by mimicking the reasoning of a specialist based on existing data and facts [7]. Their efficient application in diagnosis and problem-solving has made these systems widely used, including in web-based systems for diagnosing diseases by effectively identifying user needs [8], [9], [10]. Essentially, these systems emulate expert knowledge into computers, enabling them to address problems typically handled by experts [11].

The advantage of web technology is its ability to enable system access anytime and anywhere, thus expanding its reach. With technological advancements, this will facilitate early disease diagnosis through perceived symptoms [12], [13]. In a healthcare context, this system can analyze patient symptoms to provide possible diagnoses and follow-up recommendations. Thus, a web-based expert system can improve public understanding of cancer and GERD, while also serving as a consultation service for diagnosis based on existing clinical symptoms [14], [15], [16].

This study aims to design a web-based expert system to assist in the early diagnosis of cancer and GERD. By integrating expert medical knowledge and inference methods, this system is designed to provide accurate and easily accessible diagnostic information. It is hoped that the integration of this expert system with a web platform can be an innovative solution to improve the effectiveness of early detection of both diseases.

2. Research Method

This research begins with a systems analysis phase, where the information system is broken down into smaller components to identify and assess existing problems, opportunities, constraints, and needs. The

goal of this phase is to develop appropriate improvement recommendations. Following this, the system design phase, which describes the input and output process flows that the system will produce, is carried out. This phase is visualized through data flow diagrams (DFD) and context diagrams, which show the movement and interaction of data within the designed system. The design process includes several important steps, such as preparing a context diagram to provide an overview of the system, creating a DFD diagram to describe the details of the context diagram, designing an Entity Relationship Diagram (ERD) and developing a table design and input/output system. The context diagram used in this research is shown in Figure 1.

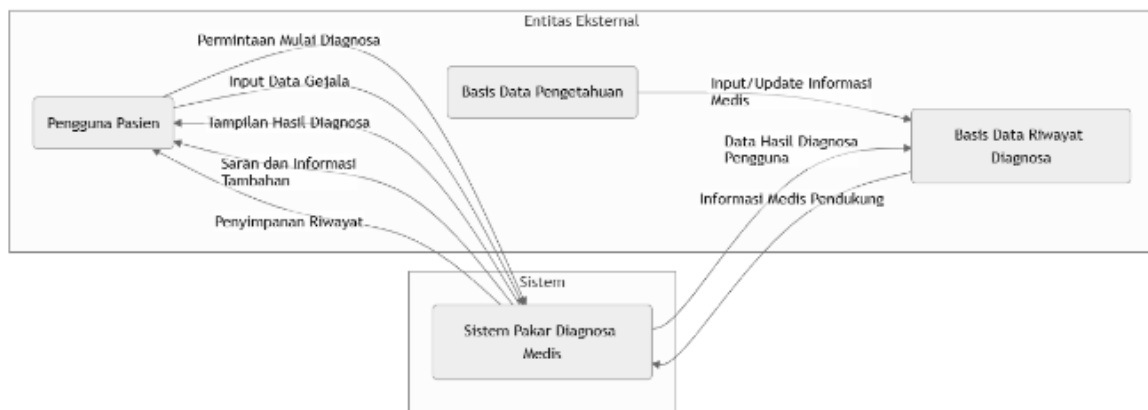


Figure 1. Context Diagram

The following is a description of the flow of events in the diagram above:

1. Start Diagnosis: This event is triggered when the user presses the "Start" button. In response, the system displays a symptom input form that the user can fill out to begin the initial analysis process.
2. Symptom Analysis: After the user submits a list of symptoms they are experiencing, the system will immediately respond by analyzing these symptoms. This analysis process is carried out by comparing the user's input data with the system's knowledge base.
3. Cancer Diagnosis: If the analysis results indicate that the user's symptoms strongly point to cancer, the system will display the diagnosis. Furthermore, the system will provide suggestions or next steps relevant to this condition.

4. GERD Diagnosis: If the user's symptoms are more suggestive of Gastroesophageal Reflux Disease (GERD), the system will display the diagnosis as GERD. This response will also include appropriate suggestions for managing the condition.
5. Save History & Complete: As soon as the diagnosis results (whether for cancer, GERD, or another condition) are displayed to the user, the system will automatically save a summary of the diagnosis results to the user's history. Once saved successfully, the diagnosis session is considered complete.

To complement the context diagram, the author also developed an Entity Relationship Diagram (ERD). The primary purpose of this ERD is to present a model of the relationships between data elements within the database, with an emphasis on basic objects and the relationships formed between them. A more detailed presentation of the ERD can be found in Figure 2.

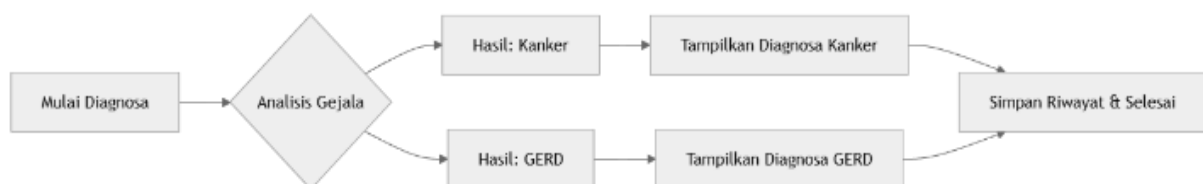


Figure 2. Entity Relationship Diagram

To build this expert system, Visual Studio Code (VS Code) was used as the primary software to create the knowledge base and interface. This system was developed using programming languages such as Python, JavaScript, HTML, and CSS, which are flexible for integration with other systems. All patient data and medical information will be stored in Python's built-in SQLite database. Ultimately, this system will be implemented as a website for easy access by users from any device with an internet connection.

3. Result and Discussion

3.1. System Implementation Results

This system implementation study will outline the program interface, including an explanation of the functionality of the main web page and its menus. It will also discuss the forms used for data input, the data presentation forms in tables and diagrams, and the settings section. The discussion then continues with the forms that handle patient diagnosis and registration, including forms for selecting relevant symptoms and forms that display diagnostic information for patients.

Based on modern research, the User Interface (UI) is viewed as a crucial component that bridges user perception with system functionality digitally [17]. UI is not simply a visual aesthetic element such as color and icon selection, but rather an interactive design that fundamentally influences the usability or ease of use of an application/website. This system interface is designed to be accessed via Google Chrome. The data entry process is presented in the form of a form page, which covers patient registration, diagnosis, disease input, symptoms, rules, and reports.

3.2. Website Login Page

The Login page is the authentication page first displayed when a user attempts to access the private area of the cancer and GERD diagnosis expert system. On the main page, there is a form containing two main fields: Email and Password. Users who already have an account can directly click the "Login" button to enter, while new users can select the "Daftar" link, which will take them to the registration page. A screenshot of this page can be seen in Figure 3.

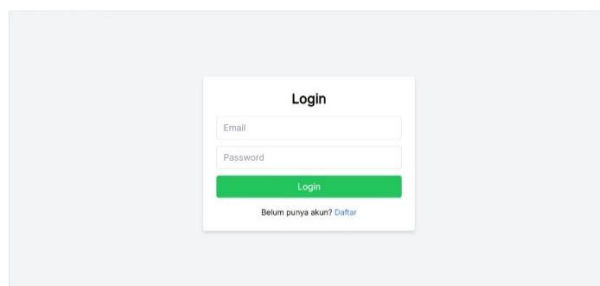


Figure 3. Login Page for the Cancer and GERD Diagnosis Expert System

3.3. Website Main Page

The Home page, or main page, is the first page displayed after successfully logging into the Expert System. On this page, there is a main navigation menu on the left side consisting of several sections, including Home, Diagnosis, Diagnosis History, Disease Information, and Statistics. Users who wish to begin the symptom analysis process can directly select the "Mulai Diagnosa Sekarang" button, which will take them to the diagnosis page. A screenshot of this page can be seen in Figure 4.



Figure 4. Main Page of the Cancer and GERD Diagnosis Expert System

3.4. Diagnosis Type Selection Page

The diagnosis page is the page that appears after users select the menu to start diagnosis from the main page. On the main page, there are two main diagnosis options to choose from: "Diagnosa Kanker" and "Diagnosa GERD". Users are required to select one of these disease types, which will then take them to a page to select relevant symptoms. A preview of this page can be seen in Figure 5.



Figure 5. Diagnosis Type Selection Page

3.5. Questionnaire Page

The Cancer Diagnosis page is the questionnaire page that appears after users select a cancer diagnosis type from the previous page. On this page, there are a series of questions related to symptoms that users must answer. Users must answer each question sequentially by clicking the "Selanjutnya" button, which will take them to the next question until the diagnosis process is complete. A preview of this page can be seen in Figure 6.

Figure 6. Questionnaire Page

3.6. Diagnosis Results Page

This is the final page that appears after users have completed answering all questions on the questionnaire. This page contains several key components for displaying results, including a pie chart showing the system's confidence percentage and initial recommendations such as "Yang Harus Dihindari". Users can view a summary of the results based on their answers and return to the previous page by clicking the "Kembali ke Diagnosa" button. A preview of this page is shown in Figure 7.



Figure 7. Diagnosis Results Page

3.7. Diagnosis History Page

This page can be accessed from the navigation menu to review previous consultation records. This page contains a table displaying the history, including columns displaying the date, diagnosis conclusion, and number of symptoms. Users can review each diagnosis and select the "Lihat" button, which will take them to the detailed diagnosis results page. A preview of this page is shown in Figure 8.

Tanggal	Diagnosa	Jumlah Gejala "Ya"	Jumlah Gejala "Tidak"	Aksi
2025-05-31 22:03:09	Anda terindikasi mengidap kanker. Segera konsultasikan ke dokter.	8	2	Lihat
2025-05-31 22:00:01	Anda terindikasi mengidap kanker. Segera konsultasikan ke dokter.	10	0	Lihat
2025-05-11 21:16:36	Anda kemungkinan mengalami Maag.	4	7	Lihat
2025-05-31 17:45:38	Anda kemungkinan mengalami GERD.	11	0	Lihat

Figure 8. Diagnosis History Page

3.8. Diagnosis History "Lihat" Page

The "Lihat" button in the attached figure 8 can be used to open the detailed consultation history page. This

page displays the diagnosis results, diagram, and date, as shown in figure 9.

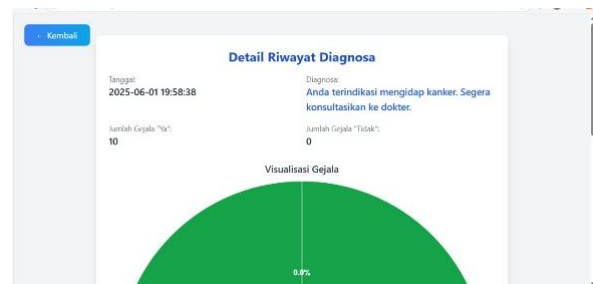


Figure 9. Detailed Diagnostic History

3.9. Disease Information Page

This is an educational page accessible from the main navigation menu to enhance user knowledge. This page displays several disease information cards, including explanations of GERD and Gastritis, complete with brief descriptions and illustrations. Users can search for specific diseases using the search bar or directly browse the available information cards, which aims to help them understand the symptoms and causes of the disease. A visual representation of this page can be seen in figure 10.



Figure 10. Disease Information Page

3.10. Diagnosis Statistics Page

This page, accessed from the navigation menu, presents a visual summary of system usage data. This page features several types of statistical graphs, including a "Distribusi Penyakit" pie chart, a "Jumlah Diagnosa per Minggu" line chart, and a "Gejala Paling Sering Dipilih" bar chart. Users can observe trends and aggregate data across all diagnoses, providing an overview of system activity. A preview of this page can be seen in Figures 11 and 13.



Figure 11. Disease Distribution Statistics

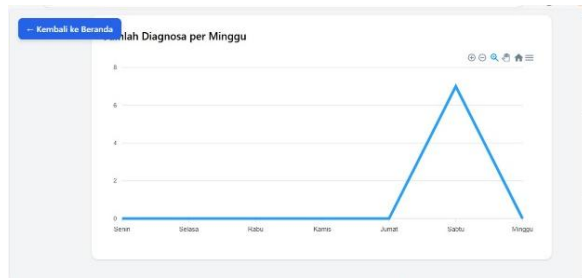


Figure 12. Number of Diagnoses per Week



Figure 13. Most Frequently Selected Symptoms

3.11. Discussion

This research focuses on the development of a web-based expert system designed to support the diagnosis of Gastroesophageal Reflux Disease (GERD) and Cancer, utilizing an approach that allows disease identification based on user-reported symptoms. Within the context of this system, pages such as the login page, the main dashboard with diagnosis options (Cancer or GERD), the symptom questionnaire, and the diagnostic results display are designed to create a smooth and accessible interaction flow for users.

The system's primary functionality lies in its ability to collect specific symptoms from users through a structured questionnaire process, which is then processed to provide an initial diagnosis. The system not only serves as an initial diagnostic tool for users but also offers a comprehensive statistics module. This statistics module, as illustrated by graphs of disease distribution, symptom frequency, and the number of weekly diagnoses, is invaluable for administrators and researchers. It allows for monitoring usage patterns, identifying dominant symptoms, and analyzing diagnosis trends over time, which can serve as a basis for further system development and improvement.

While this system shows great potential as a quick and accessible initial tool, several limitations should be acknowledged. Diagnostic accuracy is highly dependent on the honesty and accuracy of the symptom data entered by users. The risk of data inaccuracy, whether intentional or unintentional, can impact diagnostic outcomes. Therefore, further research could explore integration with other technologies, such as medical sensors or wearable devices, to collect more accurate, objective data, as suggested by similar research such as that conducted by the following

researchers [18]. Future developments could also include the addition of other disease types, integration with external medical databases, or the use of more sophisticated inference methods to improve diagnostic precision.

Thus, this web-based expert system demonstrates a significant contribution in providing a rapid and accessible initial diagnostic solution, reducing the need for in-person consultations for initial screening. Its potential to accelerate the process of identifying potential diseases and providing initial recommendations to users underscores its relevance in the context of digital healthcare, in line with the trend demonstrated by the following researchers in the context of web-based medical disease diagnosis [19].

4. Conclusion

Based on the results of the research and development that has been conducted, it can be concluded that this website-based expert system has been successfully designed to assist users in making an early diagnosis of cancer and GERD. This system is able to collect symptom data through an interactive questionnaire and provide output in the form of an initial diagnosis indication along with follow-up suggestions. Key functionalities such as registration, diagnostic process, history storage, and presentation of disease information and statistics have been successfully implemented with an easy-to-access and user-friendly interface. Although this system has proven potential as a fast and efficient screening tool, its diagnostic accuracy still depends on the quality of the data entered by the user. Therefore, this system is recommended as an initial tool and not a substitute for professional medical consultation. And hopefully, this journal can serve as a reference for future researchers and can motivate readers to increase their knowledge about journals and expert system development.

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