

Web-Based Covid-19 Monitoring Information System

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Abstract

The coronavirus is a positive-sense, enveloped, unsegmented single-stranded RNA virus. The coronavirus is classified under the order Nidovirales and the family Coronaviridae. The structure of the coronavirus has a cubic configuration, with the S protein situated on its surface. Protein S, or spike protein, is a principal antigenic protein of viruses and serves as the primary framework for gene encoding. The S protein facilitates the attachment and entrance of viruses into host cells by its interaction with certain receptors on the host cell surface. Coronaviruses are susceptible to heat and may be efficiently inactivated by disinfectants that include chlorine, lipid solvents at 56 °C for 30 minutes, ether, alcohol, peracetic acid, non-ionic detergents, formalin, oxidizing agents, and chloroform. Chlorhexidine is ineffective in neutralizing viruses. COVID-19, often referred to as the coronavirus, started to appear toward the close of 2019, and the daily incidence of infections continues to rise, with fatalities surpassing recoveries. Individuals aged 50 and above are more susceptible to developing Covid-19. The current issue is that the community struggles to monitor information on the growth of the coronavirus. This project aims to construct a web-based COVID-19 monitoring information system to facilitate public tracking of COVID-19 developments in Indonesia and worldwide. The system design methodology employs the PIECES framework (Performance, Information, Economy, Control, Efficiency, and Service) with UML (Unified Modeling Language) tools.

Keywords: *PIECES Framework, COVID-19, Monitoring Information Systems, Unified Modeling Language (UML), Service Efficiency*

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1. Introduction

Technological advances are developing rapidly, especially in web-based information technology, which increases accessibility in various fields related to distance and time efficiency. Thus, this also encourages various activities to track progress using web-based platforms. In connection with technological advances, several studies have been conducted, one of which is related to monitoring information systems. This web-based COVID-19 monitoring information system provides the latest information on the status of COVID-19 in Indonesia and abroad online, including data on positive cases, recoveries, and deaths. This technology is designed to facilitate fast and accurate information monitoring. In early 2020, the world was shocked by the emergence of a new virus, namely a novel coronavirus (SARS-CoV-2) that causes a condition known as Coronavirus disease 2019 (COVID-19), whose origins are traced to Wuhan, China, and identified in late December 2019.

So far, 65 countries have been confirmed to have been affected by the virus. Epidemiological statistics initially indicated that 66% of patients were in contact with or exposed to a seafood or live market in Wuhan, Hubei Province, China (Huang et al., 2020). Samples isolated from the patients were analyzed, indicating infection with a novel coronavirus, a betacoronavirus designated as 2019 novel coronavirus (2019-nCoV).

February 11, 2020. The current phenomenon is the increase in COVID-19 infections in Indonesia and several other countries. COVID-19, often referred to as the coronavirus, emerged towards the end of 2019, and the incidence of infection continues to increase daily, with the death toll exceeding the number of recoveries. Many websites provide and present information on the development of COVID-19; however, each site has a different design and content. The accuracy of information on monitoring and developing COVID-19 is crucial and relies on accurate and official data. Currently, the public has difficulty confirming the number of confirmed victims based on precise locations and reliable sources; so far, the information disseminated is only anecdotal, without a definitive and reliable source of truth. This application aligns with the current public needs during the coronavirus outbreak and has become a popular topic since its initial appearance in late 2019. This COVID-19 monitoring system allows the public to see that they are following the development of the virus, as it presents authentic data from the government and accurately reflects the development and monitoring status of COVID-19.

2. Method

A research method is a series of systematic steps taken by researchers to obtain relevant data or information and conduct an investigation into that data to answer the research problem. This method provides a comprehensive overview of the research design, including research procedures and stages, implementation time, data sources used, and data processing and analysis techniques. Therefore, this section describes in detail the methods applied in the research.

This research was conducted through several interrelated stages: problem identification, data collection, system analysis and design, implementation, and testing. The problem identification stage was conducted to identify the issues inherent in the research object and to establish research boundaries to ensure the discussion remains focused and manageable. Problem identification was conducted clearly and concisely with the aim of converting the research subject into a problem that can be analyzed according to the researcher's competence and the availability of data sources. The focus of this research is the analysis and design of a Covid-19 Monitoring Information System, which aims to facilitate the public in monitoring the development of Covid-19 cases, including the number of positive cases, recovery rates, and deaths.

The data collection phase was conducted through three main methods: observation, interviews, and literature review. Observations were conducted directly at the Pasar Atas Bangko Community Health Center (UPT) to obtain a concrete picture of the Covid-19 data recording and monitoring process. Furthermore, an interview was conducted with one of the officers handling Covid-19 patients at the Pasar Atas Bangko Community Health Center (UPT)

using a questionnaire as a data collection instrument to obtain more in-depth information. Furthermore, a literature review was conducted by reviewing various written sources, such as scientific journals and other references relevant to the research and system design, which served as a theoretical basis and supporting references.

This research is a decision-making system design study, where the evaluation results of the designed system are used as a basis for improvements if problems or functional failures are found. In the analysis stage, this study uses the PIECES approach (Performance, Information, Economic, Control, Efficiency, and Service) to identify the main problems found in the running system. This analysis aims to evaluate system performance, information quality, economic aspects, control mechanisms, efficiency levels, and service quality, so that appropriate solutions can be formulated for developing a better system.

The analysis process also involves disassembling the operational information system into its component parts to detect and assess various existing problems and challenges. The analysis and design phase serves as the foundation for developing a new system that is expected to address the weaknesses of the previous system. In system design, this study applies the Unified Modeling Language (UML) approach as a modeling tool, which is used to describe the system design in a structured manner.

The system modeling uses several UML diagrams, including use case diagrams, activity diagrams, sequence diagrams, and deployment diagrams. Use case diagrams illustrate the interaction between users and the web-based Covid-19 Monitoring Information System, which allows users to monitor Covid-19 data in real time, including the number of positive cases, recoveries, and deaths. Activity diagrams are used to illustrate the flow of user activities in interacting with the system through a web page. Furthermore, sequence diagrams are used to illustrate the sequence of interactions between users and the system in carrying out certain functionality. Deployment diagrams present a representation of the system's physical architecture, including hardware, software, and interconnected artifacts in the system's implementation.

The implementation stage is carried out by realizing the results of the system design using predetermined hardware and software. The hardware used includes a computer with an Intel® Core™ i3-6006U processor, 4 GB of RAM, a 500 GB hard disk, and a 14-inch LCD monitor. Meanwhile, the supporting software used includes the Windows 10 Pro 64-bit operating system, XAMPP as a server, Enterprise Architect and Microsoft Visio as UML design tools, Macromedia Dreamweaver as an editor, and web browsers such as Google Chrome and Mozilla Firefox.

In addition to hardware and software requirements, this research also considers user requirements (brainware) as a crucial element of the system. This COVID-19 Monitoring Information System has one user level, the user, who acts as a system user with limited access rights according to predetermined functions. Therefore, all stages of this research method are expected to produce a web-based COVID-19 monitoring information system that is effective, efficient, and easy to use by the public.

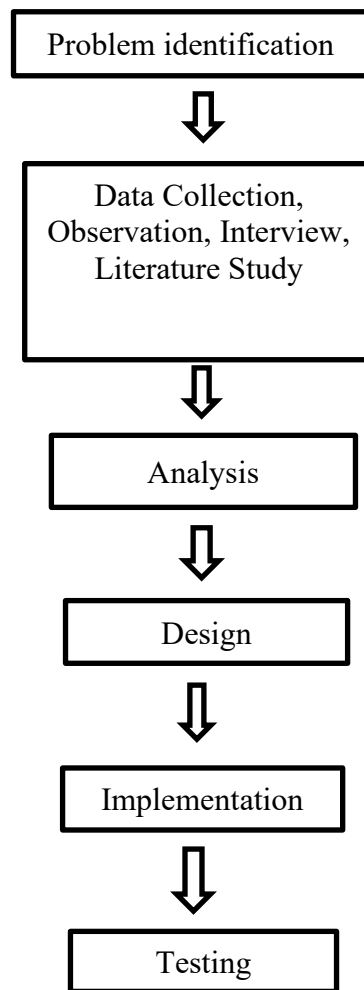


Figure 3.1 Research Framework Flowchart

3. Results and Discussion

Data collection in this study was conducted using a qualitative approach through observation and interview techniques. Observations were made by directly observing activities taking place at the Pasar Atas Bangko Technical Implementation Unit (UPT) on Monday, November 10, 2025, at 10:00 a.m. WIB (Western Indonesian Time), to obtain a factual picture of the conditions and processes occurring in the field. In addition, interviews were conducted directly with officers of the Pasar Atas Bangko Community Health Center (UPT) using a questionnaire as a research instrument, which aimed to obtain data related to the number of COVID-19 patients who were confirmed positive, recovered, and died, as well as to understand the flow of sending and managing COVID-19 patient data implemented in the institution. The collected data were then analyzed after going through the system identification and planning stages, considering that the analysis stage is a crucial stage because errors at this stage can impact the next stages of system development. The system analysis was conducted using the PIECES method to comprehensively identify major problems in the current system. In terms of performance, the existing system still shows weaknesses in the form of difficulties for the public in obtaining the latest information on COVID-19 developments, particularly in the Indragiri Hilir area. This is because some information sources still update data manually and not in real time, so the public often relies on word-of-mouth information that is not necessarily accurate. In terms of information, limited data updates result in the information received by the public being less relevant and not in line with the very rapid

dynamics of case developments. From an economic perspective, developing a COVID-19 monitoring information system does not require significant additional costs because it can utilize existing devices and infrastructure, yet it provides more optimal benefits than the old system. In terms of control, an integrated information system is needed to ensure data security and minimize errors and misuse of information that could potentially occur when providing information informally. Furthermore, in terms of efficiency, the current system is considered inefficient due to the slow process of delivering and updating information, while the COVID-19 monitoring information system is able to present data quickly and easily. In terms of service, the existence of a COVID-19 monitoring information system is expected to improve the quality of public information services by presenting accurate, up-to-date, and reliable data, thereby meeting the public's need for comprehensive information on COVID-19 developments

Design Result

The design results for this web-based COVID-19 monitoring information system encompass three main aspects: logic design, interface design, and database design. Logic design is carried out to structure the entire system, starting with a UML (Unified Modeling Language) diagram as a visual representation of the system's process flow. Use case diagrams are used to understand the logic and functions carried out by the web-based COVID-19 monitoring information system, especially for users who can access information online regarding the number of positive patients, recoveries, and deaths in real-time.



Figure 1 Global Menu View

The sequence diagram models user interaction with the system, where the user opens the main COVID-19 menu, displays Indonesian and global case data, processes the data, and then displays the results in table form.

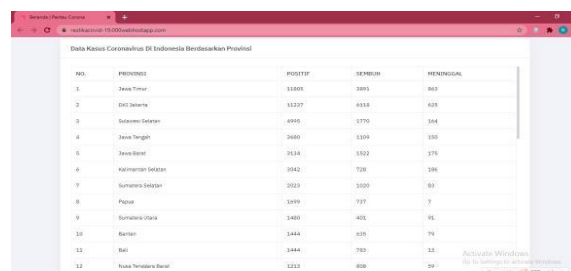


Figure 2: Table Display of Global Covid-19 Case Data

Activity diagrams illustrate the flow of user activity when using the system, from selecting Indonesian or global data to the system displaying the data results and the user exiting the system. Meanwhile, deployment diagrams provide an overview of the physical architecture of the software, hardware, and system artifacts, illustrating how system components interact in real-world environments (Figure 4.4). This modeling approach aligns with modern software

engineering principles that emphasize visual representation to facilitate understanding of system flow and ensure effective integration between software and hardware components (Sommerville, 2016).

The system interface design focuses on ease of access and clarity of information for users. The system's main menu displays COVID-19 monitoring for all provinces in Indonesia, including the number of positive cases, recoveries, and deaths. Case data per province is presented in tabular form for quick analysis and comparison. For global coverage, the system provides a similar menu and table displaying the number of COVID-19 patients in various countries in real time (Figure 4.7 and Figure 4.8). This interface design supports the principle of user-centered design, which aims to minimize data misinterpretation and increase user satisfaction in obtaining accurate information (Preece et al., 2015).

The implementation phase was conducted to operate the system in a real-world environment so that its functionality and intended objectives could be evaluated. The system's main menu displays COVID-19 monitoring across all Indonesian provinces, while the COVID-19 case data table displays information per province. The global menu and the global COVID-19 data table present similar information for various countries. This implementation demonstrates the system's ability to display real-time data from the Kawalcorona API, enabling the public and relevant parties to obtain valid and up-to-date information, which is essential for data-driven decision-making in pandemic management (WHO, 2021).

System testing was conducted using black-box testing methods to assess software functionality. Testing of the homepage demonstrated that the system successfully displayed the total number of positive, recovered, and deceased patients connected to the Kawalcorona API

Table 4.1 Home Page Testing

Testing Activities	Realization of the It is expected	Test Results	Conclusion
Go to the home page	Connect With Kawalcorona API	Total number of positive and recovered patients appears and Died	Succeed [] Fail []

The Indonesian data click test produced a table of the number of COVID-19 patients per province in real-time, while the global data click test showed that the system successfully displayed a table of COVID-19 cases in various countries

Table 4.2 Indonesian Data Click Testing

Testing Activities	Realization of the It is expected	Test Results	Conclusion
Click Indonesia n Data	Connect With Kawalcorona API	AppearTable of total positive, recovered and deceased patients based on the provinces in Indonesia	Succeed [] Fail []

Table 4.3 Global Data Click Testing

Testing Activities	Realization Which are expected	Test Results	Conclusion
Click Global Data	Connect With Kawalcorona API	A table of total positive and recovered patients appears. and Died Countries that exist in the world.	Succeed [] Fail []

The results of this test confirm that the system has operated according to specifications and can be relied upon to monitor the development of COVID-19, while also strengthening the literature stating that web-based information systems can improve the efficiency, accuracy, and accessibility of public information during a health crisis (Zhou et al., 2020).

4. Conclusion

Based on the analysis, design, and implementation results, this study successfully provides a comprehensive overview of the web-based COVID-19 monitoring information system and the issues encountered in the previous system. This system is designed to serve as a reference for developing more optimal applications with accurate needs analysis, ensuring relevant and valid data. The system implementation allows users to obtain up-to-date information on the number of positive cases, recovered patients, and deceased patients in real time, both in Indonesia and globally. The use of UML diagrams such as use cases, sequences, activities, and deployments helps model the system flow clearly and structuredly, thus facilitating integration between software and hardware. The intuitive, user-centered interface ensures users can easily access information without confusion. Black-box testing results indicate that all application functions function as intended, including the connection to the Kawalcorona API and the presentation of data in tabular form. This system reduces public reliance on inaccurate word-of-mouth information, thereby increasing the reliability of the data received. The data presented comes from official sources and is updated daily, ensuring the accuracy and reliability of the information. Furthermore, this system improves the effectiveness of information searches and makes it easier for the public and relevant parties to monitor the development of the pandemic. With its easy-to-use features, clear display, and precise information organization, this system supports data-driven decision-making. Overall, this research demonstrates that developing a web-based COVID-19 monitoring information system can be an effective solution for presenting valid and reliable data to the public. Thus, this system not only facilitates access to information but also has the potential to increase public awareness and response to the pandemic's developments..

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