Journal of Artificial Intelligence and Engineering Applications

Website: https://ioinformatic.org/

15th February 2026. Vol. 5. No. 2; e-ISSN: 2808-4519

Design and Implementation of a Web-Based Currency Converter System Using an Application Programming Interface

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Abstract

This study aims to design and implement a web-based currency converter application that utilizes an Application Programming Interface (API) to provide real-time and accurate exchange rate data. The increasing intensity of global economic activities has created a growing need for fast and reliable currency conversion, while manual conversion methods are prone to errors and data inconsistencies. This research employs the Research and Development (R&D) approach using the waterfall development model, which includes requirement analysis, system design, implementation, testing, and maintenance. The developed application provides two main features: an exchange rate calculator that performs automatic currency conversion based on real-time data, and a currency exchange history feature that presents exchange rate trends in graphical form within a selected period. Testing results indicate that the application runs reliably, delivers fast responses, and consistently displays up-to-date exchange rate information. In conclusion, the proposed application serves as an effective web-based solution for accessing accurate currency exchange information to support international financial activities.

Keywords: *Application Programming Interface; Currency Converter; Real-time; Research and Development; Waterfall*

1. Introduction

Advances in information technology have had a significant impact on the way information is obtained and managed. Information technology encourages the development of digital solutions, particularly in the economic and financial sectors. In the era of globalization and digitalization, interactions between countries through international trade, investment, cross-border transactions, and international mobility continue to increase [1]. As international trade activities expand, the need to convert one currency into another has also increased, making foreign exchange conversion a common practice in cross-border transactions [2].

However, reliance on manual currency conversion methods introduces a high risk of calculation errors. In addition, the public often receives inaccurate exchange rate information. Inaccurate exchange rate data represent a critical issue because exchange rates have a direct impact on economic stability, as explained in studies examining exchange rate relationships [3] . Therefore, society requires exchange rate information that is accurate, real-time, and easily accessible to support more informed economic decision-making. Fast access to such information can also contribute to maintaining national economic resilience [4] .

With the advancement of web technology, the utilization of Application Programming Interfaces (APIs) has become increasingly important. An Application Programming Interface is a set of rules and protocols that enables one application to communicate with another [5]. APIs are essential in financial technology for retrieving real-time, fast, and accurate data that align with the dynamic nature of today's economic environment. This need is driven by technological progress and changing user demands that are integrated into web-based applications [6].

Web-based applications offer high accessibility and emerge in response to user needs. Websites serve as network-based information media that can be accessed anytime and anywhere at a relatively low cost [7]. Furthermore, previous studies indicate that web technology enables information systems to be accessed easily across various devices without requiring installation, making it an efficient and advanced solution for users to obtain digital services quickly [8].

Although several currency conversion applications already exist, many do not provide accurate, fast, and real-time data, which can hinder users from performing precise conversions. Therefore, innovation in the financial sector has led to the development of currency converters. A currency converter is a software application that provides fast and convenient cross-country currency value conversions [9]. This study is designed to facilitate public engagement in international transactions. Exchange rate information that is not presented in real time may

lead users to make incorrect financial decisions; thus, a web-based currency converter application is required to deliver up-to-date and accurate data.

2. Literature Review

2.1. Foreign Currency Conversion

Conversion is the process of transforming a form, unit, or system into another. In the context of the global economy, foreign currency conversion plays a crucial role in supporting international trade activities, cross-border investments, and international financial transactions. Each currency has different nominal denominations, which also reflect the stability of its exchange rate. Currencies with high stability, such as the US Dollar, are commonly used as international means of payment, whereas less stable currencies are rarely utilized in global transactions [10]. In cross-border transactions, converting foreign currency into domestic currency represents the ratio between the values of local and foreign currencies. This exchange rate indicates the amount of domestic currency required to obtain one unit of foreign currency.

2.2. Website

According to Yuhefizar [11], a website is a collection of interconnected web pages that function to provide various types of information, including text, images, and audio, within a specific domain. A web page that is linked to other web pages is referred to as hypertext [12]. Websites are generally hosted on web servers and can be accessed through networks such as the Internet or a local area network (LAN) using an Internet address known as a Uniform Resource Locator (URL). The combination of all publicly accessible web pages on the Internet is referred to as the World Wide Web (WWW). The functions of a website depend on its intended purpose, including disseminating information (such as news sites, blogs, and educational portals), facilitating communication (such as social media platforms), supporting transactions (such as e-commerce), and serving as a medium for user interaction (web-based applications).

2.3. API

According to Fiqri [13], an Application Programming Interface (API) is a mechanism for invoking functions via the Hypertext Transfer Protocol (HTTP) and receiving responses in the form of Extensible Markup Language (XML) or JavaScript Object Notation (JSON). APIs can also provide extension mechanisms that allow users to expand existing functionalities in various ways and at different levels. In general, an API represents a structured interface of all available functions within a software module, which can be accessed by users or other systems through predefined methods determined by the service provider [14].

Based on access rights, APIs can be classified into several types [15]:

1. A private API is Public API refers to an open programming interface that can be accessed by anyone and is compatible with various platforms. Examples of its implementation include retrieving data on the distribution of COVID-19 cases and integrating mapping services such as Google Maps.
2. Private API is an API that is used exclusively within an organization and is not accessible to the public or external parties. An example is an API developed for backend system requirements, which subsequently supports the development of user interfaces by frontend development teams.
3. Partner API is an API provided to specific parties based on an agreed partnership arrangement. This type of API is typically used for strategic business purposes, such as system integration or data exchange between partner companies.a type of API that is only used internally by an organization and is not available to the public or external parties. An example is an API developed for back-end system purposes, which will later support interface development by the front-end developer team.

By understanding the different types of APIs, along with their characteristics and usage scopes, developers can determine the most appropriate interface for system requirements. Selecting the appropriate type of API not only streamlines the integration process but also ensures security, scalability, and flexibility in overall software development.

3. Research Methodology

3.1. Research Design

The study employs the Research and Development (R&D) method using the waterfall model to produce a web-based currency converter application that performs real-time currency conversion. The Research and Development (R&D) method is used to develop a specific software product and to evaluate the effectiveness of the developed system [16]. Meanwhile, the waterfall model is one of the most widely used Software Development Life Cycle (SDLC) models and is considered a classic approach for system development [17].

The Research and Development (R&D) method is applied to:
1. Identify user requirements
2. Design and develop the software
3. Conduct software evaluation and testing

The waterfall development model consists of several sequential stages, namely requirement analysis, system design, implementation, testing, and maintenance [18].

3.2. Population and Sample

In this study, the research population consists of tourists who require fast, accurate, and real-time foreign currency conversion information tools [19]. The population includes individuals or groups involved in currency conversion activities who therefore need access to real-time currency exchange data.

3.3. Data Collection Techniques

The following data collection techniques are used in this study:

1. Literature Study
   A literature study is a data collection technique conducted by reviewing relevant literature, journals, and scientific articles related to the research topic.
2. Observation
   Observation is a technique used to examine similar applications that are commonly utilized by users.
3. Interview
   Interviews are conducted to collect user requirements related to the ease of performing currency conversion.

3.4. Software Development Method

The following stages of the waterfall model are applied in this study:

1. Requirement Analysis
   Requirement analysis is the process of collecting and documenting all necessary system requirements, enabling users to understand the scope and limitations of the software [20].
2. Design
   Software design is the process of transforming software requirements into a structured design that can be implemented into a program. At this stage, documentation is prepared and presented to users for validation and feedback [21].

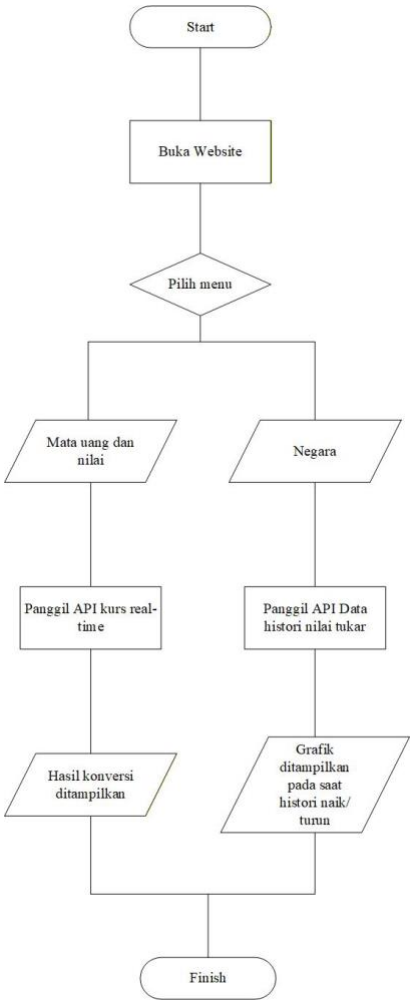

Fig. 1 : Research Flowchart

3. Implementation
   Implementation is the process of developing the system based on the established design, including coding activities carried out using the HTML programming language [22].
4. Testing
   Testing is the process of ensuring that the system meets all requirements specified during the planning phase [23].
5. Maintenance
   Maintenance is the stage in which the system is maintained and updated. If there are additions or enhancements to the features of the developed application, maintenance activities are required to ensure optimal system performance [24].

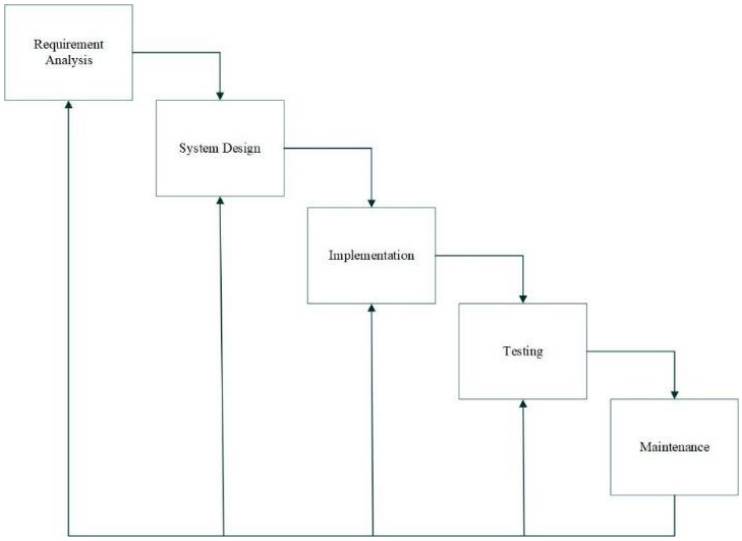

Fig. 2 : Waterfall Method Stages

4. Result and Discussion

This study resulted in the development of a web-based application integrated with an Application Programming Interface (API) that provides official currency exchange rate data from the European Central Bank (ECB). The application offers two main functions, namely the Exchange Rate Calculator and Exchange Rate History. Each of these functions plays a specific role in delivering accurate currency exchange information.

The Exchange Rate Calculator feature is designed to perform currency conversions based on exchange rates provided by the API. Users simply select the source and target currencies and input the amount to be converted. The system then automatically calculates and displays the conversion result. Meanwhile, the Exchange Rate History feature is used to display graphical representations of historical exchange rate changes based on a selected date range. The graphs are generated from historical exchange rate data retrieved through the API, processed by the system, and presented in the form of charts. Additionally, the charts can be downloaded for use in research, reports, or analytical purposes.

To clarify the system implementation, several user interface views of the developed application are presented as visual illustrations.

1. Currency Converter Application Homepage

The Homepage is designed to display the main interface of the Currency Converter application. This page includes the two primary features, namely the Exchange Rate Calculator and Exchange Rate History. Users can select the desired feature according to their needs. The simple interface design aims to facilitate ease of use, allowing users to clearly understand the application workflow. The implementation results are illustrated in Figure 3.

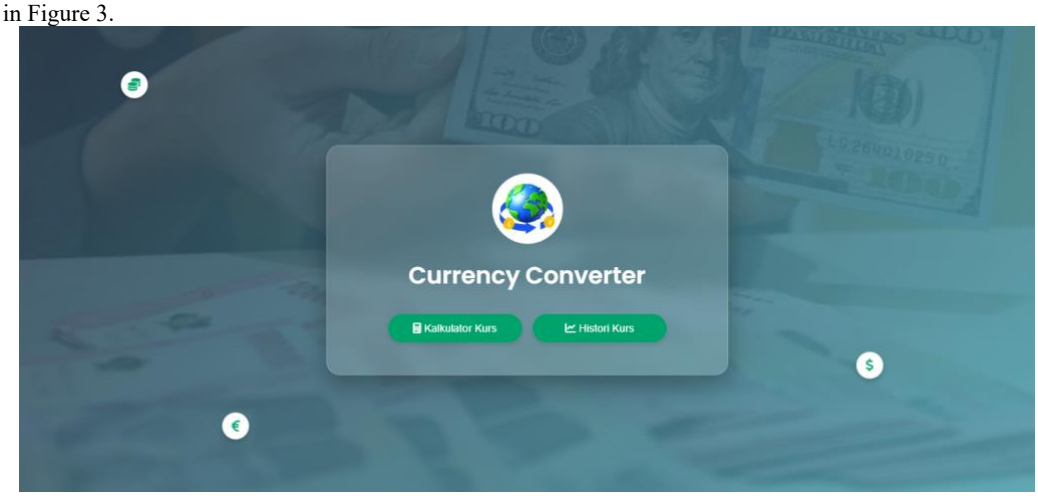

Fig. 3 : Currency Converter Application Homepage View

2. Exchange Rate Calculator Feature Page
   The Exchange Rate Calculator feature page is designed to perform currency value conversion, where users can select the source currency and the target currency, as well as enter the nominal amount to be converted. This page is connected to an Application Programming Interface (API) that automatically performs the calculation when the **"Convert Now"** button is pressed. Within the Exchange Rate Calculator feature page, a navigation button is provided to return to the main menu, namely the Homepage. The simple and intuitive design of this page facilitates ease of use, allowing users to efficiently operate the currency conversion process. The interface before conversion is shown in Figure 4, while the converted result is presented in Figure 5.

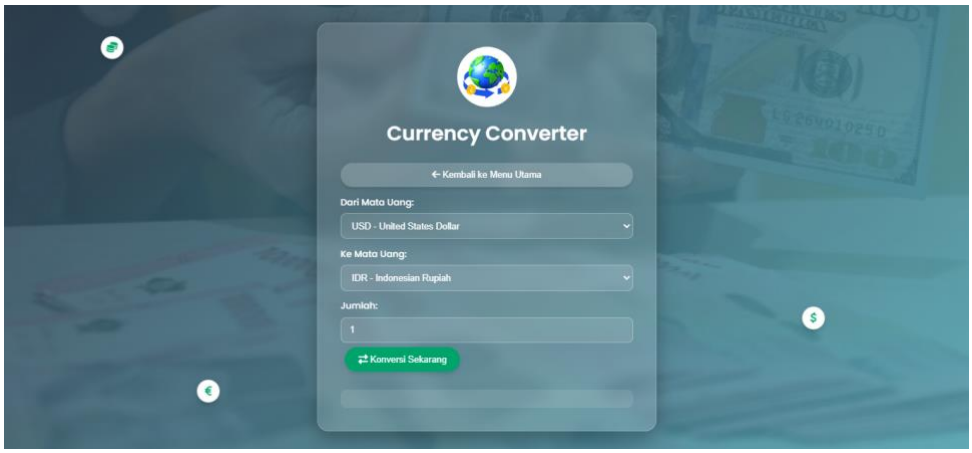

Fig. 4 : Currency Calculator Page View

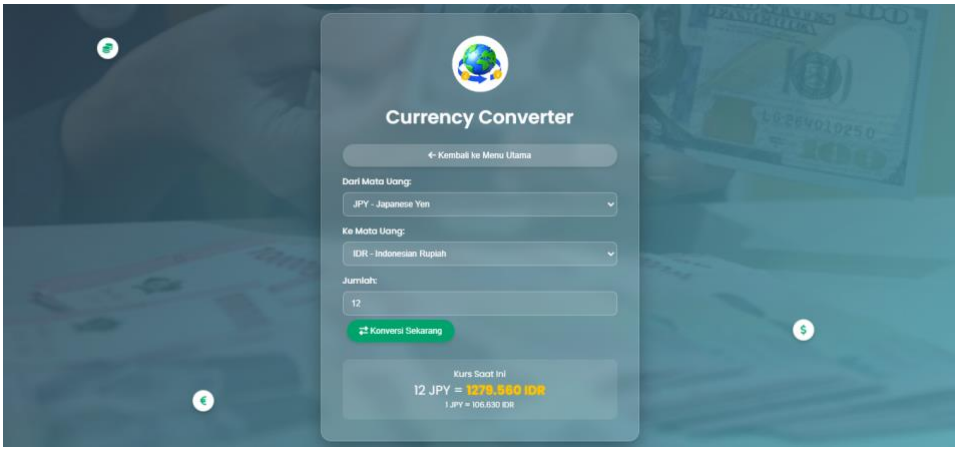

Fig. 5 : Currency Conversion Results

3. Exchange Rate History Feature Page
   The Exchange Rate History Feature page displays a graph of historical changes in currency exchange rates. To display the graph, users can select the date range, source currency, and destination currency according to their needs. After selecting all data, users can click the "Show Graph" button to display exchange rate movements for the specified period. A download feature allows users to download the graph based on the data entered by the user. The downloaded graph is saved in PNG format. The implementation results are shown in Figure 6 for the Exchange Rate History display and in Figure 7 for the downloaded graph in PNG format.

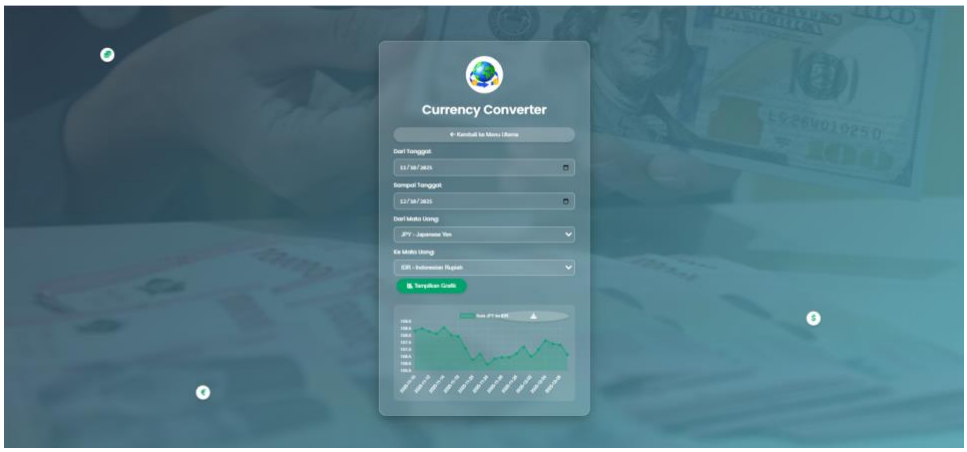

Fig. 6 : Exchange Rate History Page View

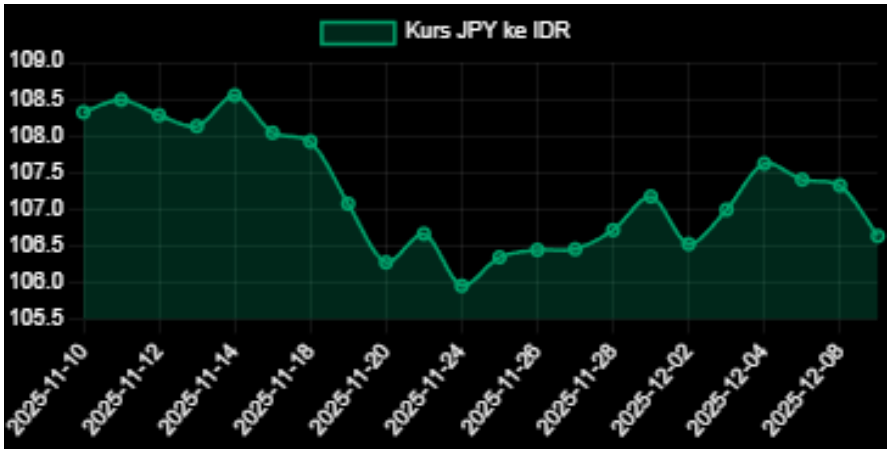

Fig. 7 : Historical Chart of JPY to IDR Exchange Rates

5. Conclusion

This study resulted in the development of a web-based currency converter application that utilizes an API to obtain real-time and accurate exchange rate data. Through the use of the API, users are able to perform automatic currency conversions and view graphical histories of exchange rate movements within a specified time range. The Research and Development (R&D) method using the waterfall development model proved to be effective in developing the system, starting from the analysis stage through to implementation and testing.

For future development, the currency converter application can be enhanced by adding additional features, such as support for a wider range of currencies and notifications for exchange rate changes. Furthermore, future studies may involve testing the application on a broader user population to obtain more comprehensive feedback and improve system performance.

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