

Dynamic Time Zone Conversion Tool with API

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ABSTRACT

This project is created to help individuals and businesses handle time zone variances, especially for international collaborations, travel or remote work, through an effective time converter tool function website. The website is designed to cater to a diverse group of users, such as professionals, students, and travelers, by providing a simple interface for converting time across different countries and regions. Besides that, this project will manage multiple country time zone and allowing user to search for the time zone then quickly compare the times across different locations. Therefore, this website will provide an advanced and intuitive user interfaces for users. By having this enhanced national time converter website, users can experience and search the different time zone more efficiently.

Keywords: Time Zone Converter, Time Zone Database, Time Zone Search, Multi-Country Time Zones, Remote Work Solutions

INTRODUCTION

In this age of globalization, a time zone is a region on the Earth's surface that follows a consistent or standard time within its boundaries, commonly referred to as local time [1]. Time zone management and fully understanding of it are extremely important for activities that involving remote work, international collaboration businesses or travel abroad. An accurate and efficient national time zone converter website can improve the capabilities of individuals or company's business.

There are several country time converter websites available on the internet, but it did not display the time API by single page layout. This can cause the user confusing the accurate and up-to-date time conversions between different time zones. Besides that, current time converter website also found that the user interface is too complex. Users are difficult to navigate the website to search for the time conversion that they wanted. There are also have some websites that not automatically retrieve the current time form atomic clock. This leads the users need to input the time based on their current time.

This project will address these challenges by developing and build an enhance national time converter website by creating the time API in one single page. This can develop a consistent user interface which only maintain a single page layout to

provide a cohesive experience to users. Besides that, user can check out the real-time updates date and time conversion without user filling input for it. Therefore, it also had simplified the process of time conversion for all users.

The time converter using API is important to users that need to use time zones conversion. The time zone is allowing reliable, secure and fast delivery of time zone data to client systems [2]. The time zone is allowing reliable, secure and fast delivery of time zone data to client systems. Besides that, the time zones conversion that using time API can make sure the accuracy and reliability of information on time zones, daylight saving changes and local times across the world. This can ensure user receiving the correct time zones information which particularly important to international business and travel.

Problem Statement

Using time converter website or internet searching for the countries time zones differentiation is a normal case

for international businesses. For an example case, an US company's software engineers involved in creating a "source code" for a computer program. Their task may remain unfinished by the end of a business day. The company chooses to send it to engineers in India over the internet to keep working on cord processing [3]. This is because during the nighttime in US, India country time zone is in daytime. These have mention that the time API can show the accurate time zones and help the businesses continue their works.

Otherwise, there are also many challenges when a company work together with remote team and members if company missing comparison of the difference time zones. The scheduling errors based on the time issues will be the biggest problem that resulting working process slow down or complex to plan the remote meeting [4].

Based on the current time zones conversion reference website that found that website not creating the time zone API in single page. This causes the user cannot access the time zone API in one page but need to access in multiple pages. Following to the data collection analysis, the result found that the interface that simplest is easier understand by users [5]. Therefore, this project will focus on creating a user interface design that providing element as simple and modern.

Objective

Below are the objectives for these projects:

1. To develop an enhance national time converter website.
2. To help users to simplify the process of comparing time zones between different countries.

Our main target for this project is to build a time zones conversion website. This website will store the time zones data into MySQL database and display all data in the user interface. This is because the website should list out all countries difference time zones for users.

Related Work

This paper aims at discussing the development and use of time zone conversion systems together with the emphasis to time zone APIs that would ensure accurate time provisions are provided. It goes through the implications of having different time zones in business, the difficulties involved in scheduling across different zones and the options that are available today in addressing such problems. Also, the review considers weakness of the current websites providing time zone conversion, especially in the aspect of having complex multiple-page layout and the necessity for having a simple one-page design. In this literature review, the author attempts to reconcile what has been learned from one study to another to come up with an improved system for time zone conversion that can suit the needs of the current globalized world.

According to 2020 study, in the whole world have more than 24 time zones and many countries will consist multiple time zones. (Robb, 2020) However, there are also have countries that only use single time zones. This represent that the time zone complex but important to state that country's time. For example, The United States has 6 time zones which is Pacific, Eastern, Alaska, Hawaii, Mountain and Central. Start from 1960, as a more precise method of measuring time, Coordinated Universal Time (UTC) started to replace Greenwich Mean Time (GMT). Local time is expressed as the difference in hours and minutes from UTC, with UTC serving as the reference point. For example, there is a 6-hour time difference between Hawaii (UTC-10) and New York (ESTZ), which is Eastern Time Zone.

Time zones had played a crucial role in modern global interactions, particularly in international trade and remote collaboration. The standardization of timekeeping, which began in the 19th century, has become essential for coordinating activities across different regions (Robb, 2020). Even though they tend to complicate the operation of the market mechanisms, time zone differences may also bring positive impacts to international trade. The "continuity effect" fosters trade because facilities can run continually throughout time zones (Nakanishi, 2019). The resulting time zone differences affect human activities in two ways which is human nature biologically adapted to fit cyclic changes of day and night and economic activities never cease due to countries in different time zones can continue to work indirectly to keep the global economy going. For example, people in Tokyo will finish their work and rest at 6:00 p.m. At the same time, people in London will begin to work in the morning

9:00a.m. This shows that time zone is important in economic view which can ensure the productivity of each country keep working.

In computer programming an Application Programming Interface can be defined as a collection of routines, protocols and tools for developing application. An API defines a software component in terms of the operations it provides, the data it requires in the form of input, data it produces in the form of output along with the data types (“Application Programming Interface, ”, n.d). According to a real-time bus arrival experiment on 2023, there is a study tries to address this problem by developing an API that could be utilized to request for information on estimated arrival time of the bus. Based on the test results, the estimated bus arrival time generated by the API could be said to be completely accurate because of the difference between the time estimated and the actual time of bus arrival is less than 30 seconds (Nugraha, 2023). Therefore, creating a time zone display website using API is necessary to get an accurate country time.

API integration is an important concept of modern web applications since it defines how the various services and data sources are to interact. In some situation, there are several APIs included for additional features to be implemented in the project and to provide the users with more facilities. According to a research article on 2020, given the popularity of web APIs that grows constantly, it is possible to use a set of existing web APIs to fulfil the given sophisticated objectives of app development (Lianyong Qi, 2020). Other APIs that can used expect Time Zone API, the country flag API also can apply. Apart from the Time Zone API, the use of the country flag API and the use of Leaflet.js mapping API enrich the site usage experience even more as it provides a converting feature to the site. In the present project, country flag API is invoked to provide the correct flag image for every country to aid the users in identifying the regions being displayed. As the authors said by (Daboo, 2016), the use of icons including a flag makes the user enjoys more and easily understand the time zone related to the content. In addition, the Leaflet.js mapping API is utilized to provide an interactive map view of the selected regions, allowing users to visualize the geographical context of time zones in a dynamic manner.

Implementation

We started collecting and finding sources for the suitable time API resources code. After that we started planning for the website overall function and software used. We designed the database using MYSQL to store the country and time zone. Totally for the country table that contains 249 rows and time zone table that contains 146586 rows. Figure 4.1 shows the table store the code and country name and Figure 4.2 shows the time zone table store zone name, country code, abbreviation, time start, gmt offset and dst.

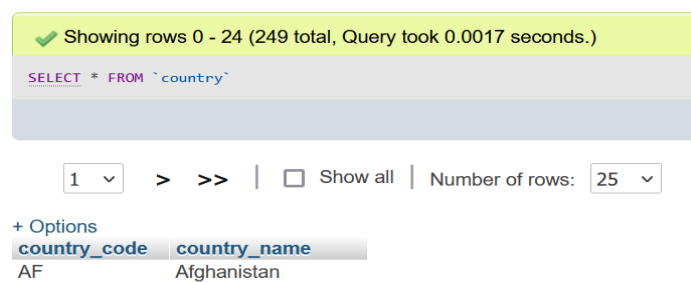


Figure 4.1 Country Table Database.

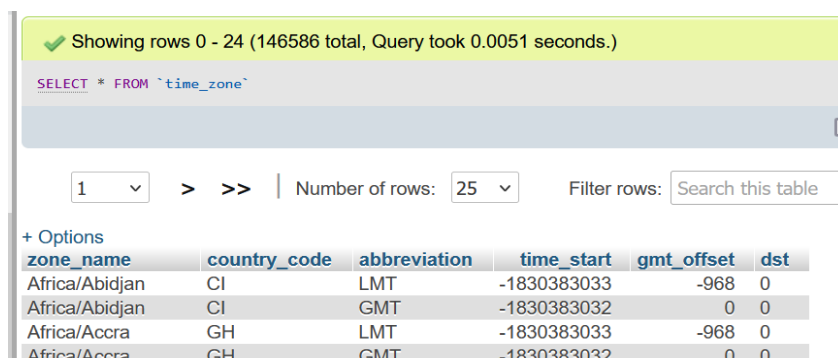


Figure 4.2. Time Zone Table Database.

The website implemented using PHP programming, JavaScript and connect to MySQL database. The web design is planned and using wired framed to design as show in figure 4.3.



Figure 4.3. Index page for displaying all country and time zone

```

if ($result->num_rows > 0) {
    while ($row = $result->fetch_assoc()) {
        $zoneName = $row['zone_name'];
        $countryCode = $row['country_code'];
        $flagUrl = $row['flag_url'];

        // Fetch the local time for each time zone
        $timeSql = "SELECT FROM_UNIXTIME(UNIX_TIMESTAMP(UTC_TIMESTAMP()) + gmtoffset, '%a, %d %b %Y, %H:%i:%s') AS local_time
        FROM time_zone
        WHERE time_start <= UNIX_TIMESTAMP(UTC_TIMESTAMP()) AND zone_name = '$zoneName'
        ORDER BY time_start DESC LIMIT 1";
        $timeResult = $conn->query($timeSql);
        $localTime = $timeResult->fetch_assoc()['local_time'];

        $timezones[] = [
            'countryName' => $countryCode,
            'zoneName' => $zoneName,
            'localTime' => $localTime,
            'flagUrl' => $flagUrl
        ];
    }
}

```

Figure 4.4. Query statement for Retrieval data from database

Figure 4.4 show the query statement for retrieval data and store into array for display at index php file.

```

}
const timeZones = data.zones.zone;
const timeContainer = document.getElementById('time-container');
timeZones.forEach(zone => {
    const timeItem = document.createElement('div');
    timeItem.className = 'time-item';

    const flagUrl = zone.flagUrl || 'https://via.placeholder.com/64?text=No+Flag';

    timeItem.innerHTML = `
        
        <h2>${zone.countryName} (${zone.zoneName})</h2>
        <p class="time-display" id="time-${zone.zoneName}">${zone.localTime}</p>
    `;
    timeContainer.appendChild(timeItem);

    // Set initial time
    let currentTime = new Date(zone.localTime);
    updateTimeDisplay(`time-${zone.zoneName}`, currentTime);

    // Update time every second
    setInterval(() => {
        currentTime.setSeconds(currentTime.getSeconds() + 1);
        updateTimeDisplay(`time-${zone.zoneName}`, currentTime);
    }, 1000);
});

```

Figure 4.5. Updating the time zone and set the interval time.

The statement passing parameter to the JavaScript to display the inner html file. The result show that the time zone based on country updated by interval time.

RESULTS

Following to Figure 5.1 is the design of the country time zone page. This page is the core element of this system, which the users can check each country capital time zone. The time zone displayed in this system can be ensure that its accurate and live display. The user experience for this page system can let user viewing the time increase second by second automatically. As the result, user did not require to reload the system to check the latest country time zone.

To make the time result accurate with the global management, the API of time zone have been used by Time Zone DB system. By fetching data from the database and requesting to access the Time Zone API using API Query and API key.

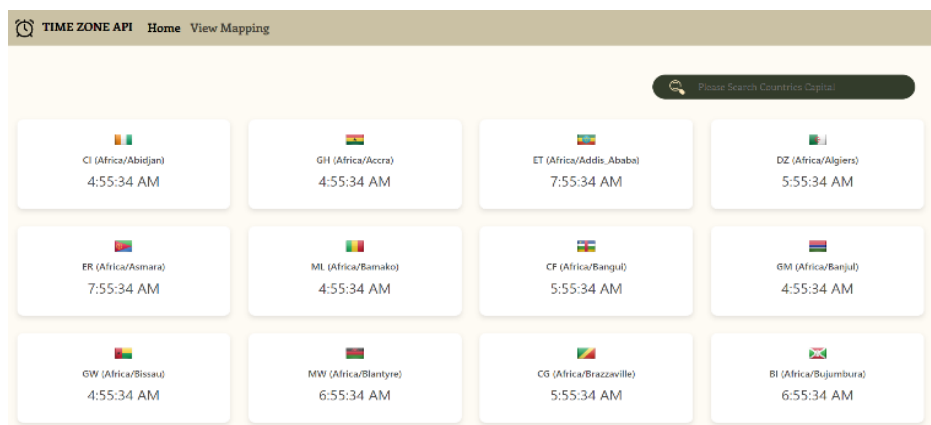


Figure 5.1 Time Zone Display Activity

The system consists of a convenient home page, a page with the time zone indicator based on the TimeZoneDB API, and an impressive mapping page that locates countries as accurately as possible. All these technologies are integrated in this project in a manner that adds a layer of usability on how to get geographical time zone information globally.

We also conducted testing were conducted on the core functionalities, including the live time zone display, and API interactions as shown in table 5.1. The home page navigation, time zone displays updates, and mapping features were thoroughly tested to ensure they met the specified requirements. Each function was checked for accuracy, and user interaction, ensuring that the website provided a seamless experience and accurate time zone information across all supported countries. Any identified issues were promptly addressed to ensure the system's reliability and usability.

Table 5.1 Testing functionalities website

Test Case Description	Test Steps	
	Expected	Test Status (Pass/Fail)
To verify that the time zone is displayed accurately for each country	The time displayed matches the current time in that country	Pass
To verify that country name and code for each time zone is accurate	The country name will write in the form such as: MY (Asia/Kuala Lumpur)	Pass
To verify the digital clock is increasing second per second automatically	User can check the time result in the view of time increasing and running automatically, no need to reload the system	Pass

CONCLUSIONS

In conclusion, the development of the enhanced national time zone converter website is important. This project aims to streamline time zone management using time zone API to display all countries difference time zones. By offering a single-page interface that apply time API for real time updates, users can ensure the accuracy of conversions and simplify the process of comparing time zones. Moreover, this project can simplify the time zones comparison process and functionally better in scheduling and coordination. Besides that, the methodology that chosen can ensure the development process in the right track, resulting in a reliable and efficient tool. Lastly, this website serves as a valuable tool for those in search of accurate and readily available time zone details.

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