HTML CALCULATOR

OBJECTIVE:

Creating a calculator using HTML
and Bootstrap

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ABSTRACT

The "HTML Calculator" is a web-based calculator application designed to perform basic arithmetic operations. This project utilizes HTML, CSS, JavaScript, and the Bootstrap framework to create a user-friendly calculator with keyboard support and error handling. Key features include support for addition, subtraction, multiplication, and division, a decimal point input, and a clear screen function. The project showcases a sleek design with a black background and responsive layout, making it accessible to users across various devices. The "HTML Calculator" serves as a functional and visually appealing tool for performing essential calculations.

The methodology section describes the development process, which involved designing the calculator's layout using HTML and applying CSS styles for visual enhancements. The JavaScript programming language was utilized to implement the calculator's core functionalities, such as input handling, calculation algorithms, and display updates.

OBJECTIVES

Development of HTML Calculator :

The primary objective of the "HTML Calculator" project is to create a fully functional web-based calculator application that serves as a versatile and user-friendly tool for performing basic arithmetic calculations. This project aims to provide a convenient and visually appealing calculator interface accessible through web browsers. The key components of this objective include:

Functionality: The calculator should be capable of performing fundamental arithmetic operations, including addition, subtraction, multiplication, and division. It should accurately evaluate mathematical expressions entered by the user and display the results in real-time.

User Interface: The user interface should be intuitive, featuring a clean and responsive design. The calculator should display both the expression being entered and the result, making it easy for users to follow their calculations.

Keyboard Support: The calculator should offer keyboard support, allowing users to enter numbers and operators using both mouse clicks and keyboard inputs. This feature enhances user accessibility and efficiency.

Error Handling: The application should implement robust error handling mechanisms to detect and gracefully handle common calculation errors, such as division by zero or invalid expressions. Clear error messages should be displayed to guide users in correcting their input.

Design Customization: The project aims to create a visually appealing calculator by leveraging CSS styles and Bootstrap components. Customization options for colors and layout should be considered to enhance the user experience.

Responsive Design: The calculator should be responsive to various screen sizes and devices, ensuring that users can access and utilize it seamlessly on both desktop and mobile platforms.

Efficient Code base: The underlying code base should be well-structured, maintainable, and adhere to best practices in HTML, CSS, and JavaScript development. This promotes code re-usability and facilitates future updates and enhancements.

Testing and Debugging: Rigorous testing should be conducted to identify and rectify any functional or visual issues. The application should be thoroughly tested across various web browsers and devices to ensure compatibility.

By achieving these objectives, the "HTML Calculator" project aims to provide users with a reliable and feature-rich calculator application that meets their basic calculation needs while offering a pleasant and intuitive user experience.

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Introduction

The calculator is a fundamental tool that has been an integral part of our daily lives, aiding us in performing arithmetic calculations quickly and accurately. With advancements in technology, calculators have transitioned from physical devices to digital applications, providing even more functionality and convenience.

The purpose of this report is to introduce and evaluate a calculator application developed using HTML, CSS, and JavaScript. This calculator serves as a practical implementation of programming concepts and showcases the power of web technologies in creating functional and user-friendly tools.

The calculator application offers a range of features and functionalities designed to cater to various mathematical needs. It includes standard arithmetic operations such as addition, subtraction, multiplication, and division, allowing users to perform basic calculations effortlessly. Additionally, it incorporates memory functions, enabling the storage and retrieval of intermediate results for more complex calculations.

One of the primary focuses during the development of this calculator was to create an intuitive and user-friendly interface. Careful attention was given to the layout, ensuring that buttons and controls are easily accessible and logically organized. Visual elements, such as colour schemes and font choices, were chosen to enhance readability and user experience.

Keyboard support, a fundamental aspect of calculator usability, is given due attention. Users can perform calculations not only through mouse clicks but also via comprehensive keyboard inputs and shortcuts. The "HTML Calculator" project aims to be accessible to all, including those who prefer or require keyboard-based interactions.

Throughout this report, we will delve into the development process, discussing the utilization of HTML for the structure and layout, CSS for styling and visual enhancements, and JavaScript for implementing the calculator's core functionalities. We will explore the challenges encountered during development and the solutions employed to overcome them, as well as the testing procedures employed to validate the accuracy and usability of the calculator.

Behind the scenes, the "HTML Calculator" project maintains a commitment to code quality and documentation. These aspects are crucial for ensuring the calculator's long-term maintainability, extensibility, and collaboration among developers.

Extensive testing and debugging efforts are undertaken to identify and resolve functional and visual issues. The application is rigorously tested across different web browsers and devices to ensure seamless compatibility, fulfilling its role as a dependable digital companion for users.

As we embark on this journey through the intricacies of the "HTML Calculator" project, we invite you to explore its development, features, and the dedication that goes into crafting a user-centric web-based calculator that aims to simplify mathematical computations while maintaining the highest standards of usability and design.

Types of Calculators

Here are some common types of calculators that you can include in your report:

1. Basic Calculators: These are the simplest form of calculators and offer basic arithmetic operations such as addition, subtraction, multiplication, and division. They typically have a numeric keypad, a display screen, and memory functions.

2. Scientific Calculators: Scientific calculators are designed for complex mathematical calculations and scientific functions. They include functions like trigonometry, logarithms, exponentials, and statistical calculations. Scientific calculators often feature additional buttons or menus to access these advanced functions.

3. Graphing Calculators: Graphing calculators go beyond basic and scientific calculations by allowing users to plot and analyze mathematical functions on a graph. They have larger displays, advanced graphing capabilities, and often include features like programmability and data analysis tools.

4. Financial Calculators: Financial calculators are specifically designed for financial calculations and planning. They assist in tasks such as calculating interest rates, loan payments, investment returns, and amortization schedules. They can also handle financial equations like time value of money calculations and cash flow analysis.

5. Programming Calculators: Programming calculators are equipped with programming capabilities and are used by programmers and software developers. These calculators support programming languages, allowing users to write and execute small programs or algorithms directly on the calculator.

6. Mobile and Online Calculators: With the advent of smartphones and web applications, mobile and online calculators have become increasingly popular. These calculators can be accessed through mobile apps or web browsers, providing convenient and accessible tools for calculations on the go.

7. Specialty Calculators: Specialty calculators cater to specific fields or industries. For example, there are calculators designed for engineering, architecture, chemistry, statistics, and other specialized disciplines. These calculators include specialized functions and formulas relevant to their respective fields.

Benefits of Calculator

Calculators have numerous benefits across various fields and in everyday life. Here are some of the key advantages of using a calculator:

1. Accuracy: Calculators provide precise and accurate calculations, minimizing human errors that can occur during manual calculations. This is particularly crucial in scientific, engineering, financial, and mathematical applications where precision is essential.

2. Time-saving: Calculators perform calculations much faster than manual methods. Complex calculations that may take a considerable amount of time when done manually can be completed within seconds using a calculator. This allows users to save time and allocate it to other important tasks.

3. Efficiency: Calculators simplify and streamline calculations, enhancing overall efficiency. With built-in functions and formulas, they can perform complex operations instantly, reducing the need for manual and repetitive calculations.

4. Versatility: Calculators come with a wide range of functions to cater to various needs. They can perform basic arithmetic operations, advanced mathematical calculations, statistical analysis, conversions, and more. Some calculators even have specialized functions for specific fields such as finance, engineering, and science.

5. Problem-solving: Calculators aid in problem-solving by providing quick solutions to equations, formulas, and mathematical problems. They can handle complex equations and allow users to focus on analyzing and interpreting the results rather than spending excessive time on calculations.

6. Learning aid: Calculators can be valuable learning tools in mathematics and scientific disciplines. They enable students to verify their work, check answers, and experiment with different scenarios. This can enhance understanding and facilitate exploration of mathematical concepts.

7. Portability: Calculators are typically compact and portable, making them convenient for use in various settings. Whether in classrooms, offices, laboratories, or during outdoor activities, calculators can be easily carried and used whenever needed.

8. Data analysis: Advanced calculators often have statistical functions that facilitate data analysis. They can compute mean, standard deviation, regression, probability, and other statistical calculations. This is particularly beneficial for researchers, statisticians, and professionals working with data.

9. Financial planning: Financial calculators assist in planning personal finances, investments, loans, mortgages, and retirement savings. They can calculate interest rates, loan payments, investment returns, and other financial metrics, helping individuals make informed decisions.

10. Problem-solving in real-life situations: Calculators are useful in everyday scenarios that involve calculations, such as splitting bills, calculating discounts, converting units, determining cooking measurements, or estimating costs. They provide convenience and accuracy in various practical situations.

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Uses of Calculator

Calculators have numerous uses across various fields and everyday situations. Here are some common uses of calculators:

1. Basic Arithmetic: Calculators are frequently used for performing basic mathematical operations like addition, subtraction, multiplication, and division. They make calculations faster and more accurate, especially when dealing with large numbers or complex calculations.

2. Education: Calculators are commonly used in schools, colleges, and universities to aid students in solving mathematical problems. They are particularly useful for advanced calculations in subjects such as algebra, trigonometry, calculus, and physics.

3. Finance and Accounting: Calculators are essential tools in finance and accounting. They are used for calculating interest rates, loan payments, investment returns, profit margins, tax calculations, and other financial computations. Specialized financial calculators, such as those with built-in functions for time value of money and depreciation, are widely used in these fields.

4. Engineering and Science: Engineers and scientists rely on calculators for complex calculations involved in their respective fields. Whether it's determining electrical circuit parameters, solving equations, analyzing statistical data, or performing scientific calculations, calculators provide a quick and accurate way to obtain results.

5. Business and Economics: In business and economics, calculators are used for a variety of purposes, including pricing analysis, cost estimation, sales forecasting, budgeting, and financial modeling. They help in making informed decisions by providing numerical insights and facilitating data analysis.

6. Construction and Architecture: Calculators play a crucial role in construction and architecture by assisting in measurements, conversions, and estimating material quantities. They are used for tasks like area calculations, volume calculations, unit conversions, and scaling.

7. Programming and Computer Science: Calculators with programming capabilities, such as graphing calculators, are widely used by programmers and computer scientists. These

calculators can execute programs, performance calculations in various number systems, and help visualize mathematical functions and data.

8. Personal and Everyday Use: Calculators are handy tools for everyday calculations. Whether it's calculating tips, splitting bills, converting currencies, determining cooking measurements, or solving household math problems, calculators are useful in various personal and domestic scenarios.

Technologies Used in Normal Calculator

Calculators, both physical and digital, rely on a combination of hardware and software technologies to perform mathematical calculations quickly and accurately. Here are the main technologies behind calculators:

1. Integrated Circuits (ICs): Calculators use integrated circuits, specifically microprocessors, which are the brain of the device. These ICs contain millions of transistors that can perform complex calculations and execute instructions.

2. Microprocessors: Most modern calculators use microprocessors, which are integrated circuits that contain a central processing unit (CPU). Microprocessors are responsible for executing mathematical calculations and managing the overall operation of the calculator.

3. Display Technology: Calculators typically use different types of display technologies to show numbers and symbols. Early calculators used mechanical displays with rotating wheels or moving rods, but modern calculators usually employ electronic displays such as liquid crystal displays (LCDs) or light-emitting diode (LED) displays. These displays allow for clear and compact representation of numbers and characters.

4. Keypad: The keypad of a calculator consists of a set of buttons or keys that allow users to input numbers, operators, and functions. Keypads can be made of various materials, such as plastic or rubber, and may include additional features like navigation buttons and function keys.

5. Power Source: Calculators can be powered by various sources, including batteries, solar panels, or a combination of both. Battery-powered calculators typically use small button cell batteries or rechargeable batteries. Solar-powered calculators rely on photovoltaic cells to convert light energy into electrical energy, providing power for the calculator's operation.

6. Memory: Calculators often incorporate memory functions to store and recall values or intermediate results. This memory can be implemented using different types of storage technologies, including random access memory (RAM) or read-only memory (ROM). RAM is used for temporary storage of data during calculations, while ROM is used to store fixed programs or constants.

7. Software and Firmware: Modern calculators may have built-in software or firmware that enables them to perform advanced functions, such as trigonometric calculations, statistical analysis, or graphing.

Methodologies Used in Our HTML Calculator

While dealing with this awesome project, I came across many difficulties and opportunity to learn. The methodology used in this calculator involves a combination of HTML, CSS, and JavaScript to create a functional and interactive calculator application. Below is a detailed explanation of the methodology:

HTML (Hypertext Markup Language): It is the standard markup language used for creating the structure and content of web pages. Here, I used different HTML elements like input tag, heading tag,etc. Some of them used are briefly explained below :-

i. <input> - Here, we include all our elements like button ,etc. ,where we can give input to the system to produce some type of output.

ii. <style> - It includes all types of styling ingredients to our page. It is just like a skin and flesh to our skeleton. For a web developer, it is necessary to provide some colors ,margins, borders, etc. to the web page he/she is making. Some of its elements include background, border, width, height, background color, padding , etc.

iii. <form> - It is used to create an HTML form for user input. We have made a screen (form) for our calculator.

iv. Document Structure - The HTML file defines the structure of the calculator user interface. It includes elements for the calculator display, buttons, and other UI components.

CSS (Cascading Style Sheets): We have also encountered against many CSS elements , which are used in order to make our web page more impressive. CSS (Cascading Style Sheets) is used to enhance the visual appearance and layout of the website. CSS is used to style the calculator's appearance. It sets properties like colors, fonts, button sizes, and the overall layout. In this calculator, custom styles are applied to make it visually appealing and user-friendly.

Some of its elements we used are:-

i. .container - It is used with <input> tag to make a container or space for making the calculator itself.

ii. .calc - It's used for each of those blocks used for every digits, arithmetic operators such as '+', '-', etc. , with their border radius, padding, color, etc.

iii. .calc-disp - It’s used for styling the display part of the calculator with the attributes like, its background color, height, width, border radius, etc.

JavaScript:

Event Handling: JavaScript is the core technology responsible for the calculator's functionality. It handles user interactions and performs calculations.

Here's a breakdown of JavaScript functions and methodologies used:

Event Listeners: Event listeners are attached to calculator buttons to capture user clicks and keypress events. These listeners trigger specific functions based on the user's input.

Key Handling: The calculator responds to both mouse clicks and keyboard input. Keydown and keyup events are used to detect keypresses, allowing users to enter numbers, operators, and perform calculations using their keyboards.

Expression Handling: The calculator stores the current expression in a variable (currexp). When users input numbers or operators, the expression is updated accordingly. For example, pressing '1' and '+' results in the expression '1+'.

Expression Evaluation: When the user presses the '=' button or hits the Enter key, the calculator evaluates the expression using the eval() function. It checks for errors like division by zero or invalid expressions and displays the result or an error message.

Backspace Functionality: The calculator allows users to delete the last character in the expression using the 'Backspace' key or a dedicated button. The handleBackspace() function removes the last character from the expression.

Decimal Handling: The calculator ensures that only valid decimal numbers are entered. It prevents multiple decimal points in a number and handles leading zeros.

Error Handling: If the user enters an invalid expression or attempts to divide by zero, the calculator displays an error message and clears the expression after a brief delay.

Clear Functionality: The 'CE' button allows users to clear the current expression, while the 'C' button clears both the expression and the result.

Operator Handling: The calculator prevents consecutive operators and handles operator precedence. For example, it removes extra operators when the user enters '1++' and allows parentheses for grouping.

Display Updates: JavaScript updates the calculator's display in real-time as users input numbers and operators. It also updates the display with the result or error message upon evaluation.

More additional details to this:-

Event Handling and Key Press Detection:

The calculator captures user interactions through event handling. It uses event listeners to respond to button clicks and keyboard input.

Keydown and keyup events are specifically utilized to detect keyboard key presses. When a key is pressed, the associated event handler function is called to handle the input appropriately.

Expression Storage and Manipulation:

The calculator maintains an Expression variable that stores the current mathematical expression. As users enter numbers and operators, this expression is dynamically updated.

When a user clicks an operator button or presses an operator key (+, -, *, /), the corresponding operator is appended to the expression.

The calculator prevents scenarios where consecutive operators are entered or where an operator is the first character in the expression.

Decimal Point Handling:

Decimal numbers are a crucial aspect of the calculator. It allows users to input and calculate non-integer values.

The calculator ensures that only one decimal point is allowed in each number, preventing invalid inputs like "3.14.2."

Error Handling and Validation:

The calculator employs comprehensive error handling to provide a smooth user experience.

It checks for division by zero by examining the expression before evaluation. If such an operation is detected, an error message is displayed.

If the expression is empty, incomplete, or contains syntax errors, the calculator displays an error message to inform the user.

Display Updates:

Real-time updates of the calculator's display are achieved through JavaScript. As users input numbers and operators, the expression is displayed on the screen.

When the calculation is complete, the result or error message is presented to the user, replacing the expression on the display.

Operator Precedence:

The calculator follows standard operator precedence rules. For instance, multiplication and division take precedence over addition and subtraction.

Parentheses can be used to override operator precedence, and the calculator ensures they are used correctly.

Clear Functionality:

One clear button is provided: 'CE' (Clear Entry).

'CE' clears the current expression, allowing users to start fresh within the same expression.

External Libraries and Frameworks:

The Bootstrap framework is used for styling certain UI components. It ensures a modern and responsive design for the calculator.

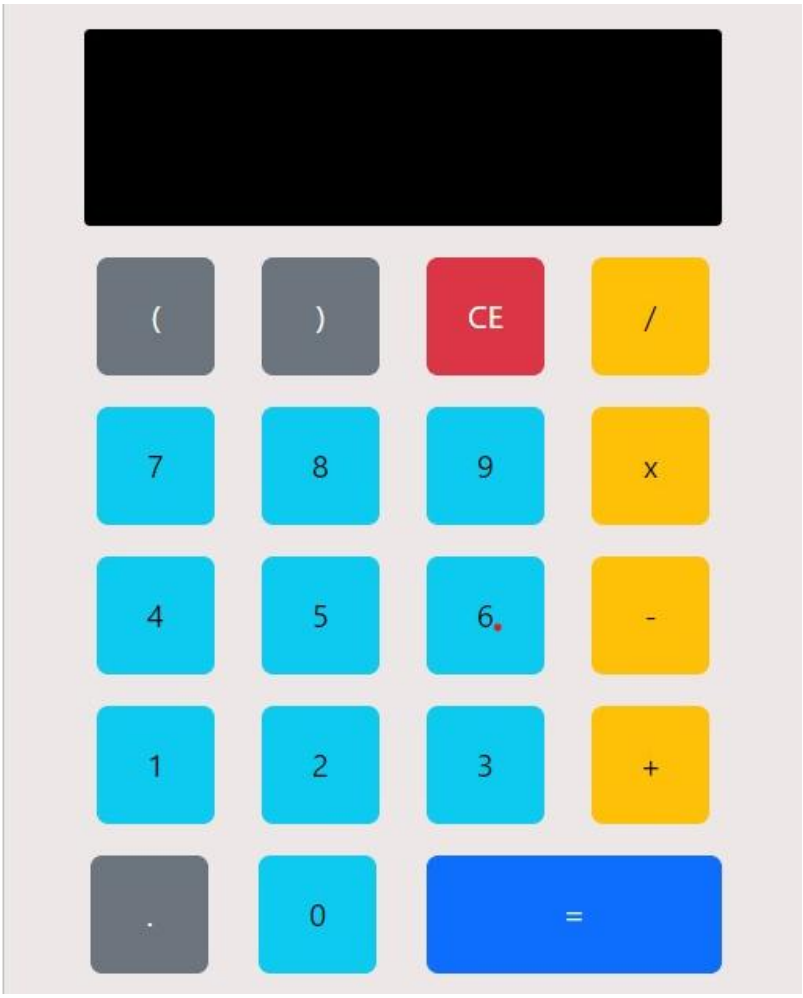
Responsive Design:

The calculator is designed to be responsive, adapting to different screen sizes and orientations, making it usable on various devices.

The major Arithmetic operations are made using JavaScript. So, we get a well functioned Calculator combining them altogether. In summary, the calculator's methodology encompasses a robust combination of event handling, expression manipulation, error handling, and display management. It adheres to mathematical rules and provides an interactive and user-friendly experience for performing basic arithmetic calculations.

Look of the HTML Calculator -

As a result, it looks somewhat like this:-



Code (Screenshots only)-

```html
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="utf-8" name="viewport" content="width=device-width, initial-scale=1">
    <title>HTML CALCULATOR</title>
    <link href="bootstrap.css" rel="stylesheet">
    <link href="bootstrap.css.map" rel="stylesheet">
    <link rel="stylesheet"
        href="https://cdnjs.cloudflare.com/ajax/libs/bootstrap-icons/1.11.1/font/bootstrap-icons.min.css"
        integrity="sha512-oAvZuuYVzkcTc2dH5z1ZJup5OmSQ000qlfRvuoTTiyTBjwX1faoyearj8KdMq0LgsBTHMrRuMek7s+CxF8yE+w=="
        crossorigin="anonymous" referrerpolicy="no-referrer" />

    <style>
        .calc-btn {
            height: 60px;
            width: 60px;
        }

        .calc-disp {
            background-color: black;
            color: white;
            height: 100px;
            width: 325px;
            border-radius: 3px;
        }

        .ExpressionString {
            margin-top: 5px;
            height: 20px;
            display: block;
            font-size: 20px;
        }

        .valuestring {
            margin-top: 5px;
            height: 20px;
            display: block;
            font-size: 20px;
        }
    </style>
</head>
```

Head Part of the code

```
<body>
    <!--Calculator-->
    <div class="container p-5">
        <div class="d-flex justify-content-center">
            <div class="col-sm-12 col-md-4 col-lg-4">
                <div class="card" style="background-color: rgb(237, 232, 232); padding-bottom: 5%; padding-top: 5%;">
                    <!--Calculator Output Screen-->
                    <div class="d-flex justify-content-center p-2 align-items-center">
                        <div class="row">
                            <!--calculator columns for buttons-->
                            <div class="col-sm-12 col-md-12 col-lg-12 col-xl-12 calc-disp">
                                <div id="Expression" class="ExpressionString"></div>
                                <div id="value_div" class="valuestring"></div>
                            </div>
                            <input type="hidden" id="savedexp">
                        </div>
                    </div>

                    <!--calculator rows for buttons styling in rows-->
                    <div class="d-flex justify-content-center p-2 align-items-center">
                        <div class="row">
                            <!--calculator columns for buttons-->
                            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                                <button type="button" class="btn btn-secondary calc-btn" title="Braces Start"
                                    data-event_key="(">(</button>
                            </div>
                            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                                <button type="button" class="btn btn-secondary calc-btn" title="Braces End"
                                    data-event_key=")">)</button>
                            </div>
                            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                                <button type="button" class="btn btn-danger calc-btn" title="Clear Screen"
                                    data-event_key="Delete">CE</button>
                            </div>
                            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                                <button type="button" class="btn btn-warning calc-btn" title="Divide" data-event_key="/">/</button>
                            </div>
                        </div>
                    </div>
```

Body part (1)

```
    <div class="d-flex justify-content-center p-2 align-items-center">
        <div class="row">
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="7">7</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="8">8</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="9">9</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-warning calc-btn" title="Multiply"
                    data-event_key="*">x</button>
            </div>
        </div>
    </div>
    <div class="d-flex justify-content-center p-2 align-items-center">
        <div class="row">
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="4">4</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="5">5</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="6">6</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-warning calc-btn" title="Subtract"
                    data-event_key="-">-</button>
            </div>
        </div>
    </div>
    <div class="d-flex justify-content-center p-2 align-items-center">
        <div class="row">
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="1">1</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="2">2</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-info calc-btn" data-event_key="3">3</button>
            </div>
            <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                <button type="button" class="btn btn-warning calc-btn" title="Add" data-event_key="+">+</button>
            </div>
        </div>
    </div>
```

Body part (2)

```
            <div class="d-flex justify-content-center p-2 align-items-center">
                <div class="row">
                    <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                        <button type="button" class="btn btn-secondary calc-btn" data-event_key=".">.</button>
                    </div>
                    <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                        <button type="button" class="btn btn-info calc-btn" data-event_key="0">0</button>
                    </div>
                    <div class="col-sm-3 col-md-3 col-lg-3 col-xl-3">
                        <button type="button" class="btn btn-primary calc-btn" style="width: 150px;" data-event_key="=">=</button>
                    </div>
                </div>
            </div>
        </div>
    </div>
</div>
```

Body part (3)

```
<script src="https://ajax.googleapis.com/ajax/libs/jquery/3.7.1/jquery.min.js"></script>
<script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/2.9.2/umd/popper.min.js"
    integrity="sha512-2rNj2KJ+D8s1ceNasTIex6z4HWyOnEYLVC3FigGOmyQCZc2eBXKgOxQmo3oKLHyfcj53uz4QMsRCWNbLd32Q1g=="
    crossorigin="anonymous" referrerpolicy="no-referrer"></script>
<script src="bootstrap.js"></script>
<script>
    var currexp = "";
    $(document).on('keydown', function (e) {
        var key = e.key;
        if (key == undefined) {
            key = String.fromCharCode(e.which);
        }

        if (e.key == '.') {
            //decimal point handled separately
            handleDecimalPoint();
            e.preventDefault();
        } else {
            if ((e.keyCode >= 48 && e.keyCode <= 57) || (e.keyCode >= 96 && e.keyCode <= 105)) {
                addnum(e.key);
            } else {
                if (e.key == '+' || e.key == '-' || e.key == '*' || e.key == '/' || e.key == '(' || e.key == ')') {
                    operatorhandler(e.key);
                    generateexp(e.key);
                } else if (e.key == "=") {
                    try {
                        evalexp();
                    } catch (error) {
                        displayError(error.message);
                    }
                } else if (e.key == "Delete") {
                    clearcalc();
                }
            }
            console.log("Key pressed:", e.key);
        }
        e.preventDefault();
    });


    $(document).on('keyup', function (e) {
        $('button[data-event_key="' + e.key + '"]').removeClass('active')
        console.log(e);
    })
```

Script part (1)

```
$('.calc-btn').on('click', function (e) {
    var key = $(this).data('event_key');

    if (key != "+" && key != "-" && key != "*" && key != "/" && key != "." && key != "Delete" && key != "=" && key != "(" && key != ")" && key != "Clear") {
        addnum(key);
    }
    else {
        if (key == '+' || key == '-' || key == '*' || key == '/' || key == '(' || key == ')') {
            generateexp(key);
        }
        else if (key == "=") {
            evalexp();
        }
        else if (key == "Delete") {
            clearcalc();
        }
    }
    console.log(key);
})

$('.calc-btn[data-event_key="."]').on('click', function (e) {
    e.preventDefault();
    handleDecimalPoint();
});

function handleDecimalPoint() {
    var currexp = $("#Expression").text();
    var lastChar = currexp.slice(-1);

    if (!isOperator(lastChar) || lastChar === '0') {
        addnum('.');
    }
}
```

Script part (2)

```
function addnum(num) {
    var existingnum = $("#Expression").text();
    var currstring = num;
    var outputstring = '';

    // Check if the current string is a decimal point
    if (currstring === '.') {
        var lastChar = existingnum.slice(-1);
        if (isOperator(lastChar) || existingnum === '') {
            outputstring = '0' + currstring;
        } else if (lastChar === '.') {
            // Do nothing if the last character is already a decimal point
            outputstring = existingnum;
        } else {
            outputstring = existingnum + currstring;
        }
    } else {
        outputstring = existingnum + currstring;
    }

    $("#Expression").text(outputstring);
}

// Helper function to check if a character is an operator
function isOperator(char) {
    return ['+', '-', '*', '/'].includes(char);
}

function generateexp(operator) {
    var existingExpression = $("#Expression").text();
    var curroperator = operator;
    var newExpression = existingExpression + curroperator;
    $("#Expression").text(newExpression);
}

function evalexp() {
    var result = "";
    var Expression = $("#savedexp").val();
    var existingnum = $("#Expression").text();

    if (existingnum != '' || existingnum != null || existingnum != undefined) {
        Expression = Expression + existingnum;
    }
    try {
        if (Expression.includes('/0')) {
            throw "Division by zero is not allowed.";
        }
        result = eval(Expression);
        if (isNaN(result)) {
            throw "Invalid expression";
        }
        $("#savedexp").val("");

        $("#Expression").text("");
        $("#value_div").html(result);
```

Script part (3)

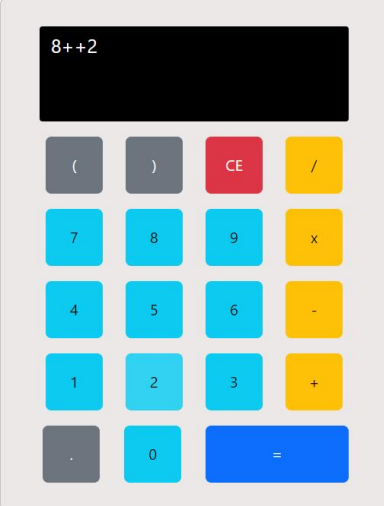
```
            $("#Expression").text("");
            $("#value_div").html(result);
        } catch (error) {
            displayError("Error: " + error);
        }
    }

    function clearcalc() {
        $("#Expression").text("");
        $("#savedexp").val("");
        $("#value_div").html("");
    }

    function operatorhandler(operator) {
        if (currexp.length > 0) {
            var lastchar = currexp.slice(-1);
            if (lastchar == '+' || lastchar == '-' || lastchar == '*' || lastchar == '/') {
                //remove last repeating operator
                currexp = currexp.slice(0, -1);
            }
        }
        if ((operator == '+' || operator == '-' || operator == '*' || operator == '/') && (currexp.endsWith('(') || currexp.endsWith(')'))) {
            return;
        }
        currexp += operator;
        updateExpressionDisplay(currexp);
    }

    function updateExpressionDisplay(Expression) {
        $("#Expression").text(Expression);
    }

    function displayError(errorMessage) {
        $("#Expression").text(errorMessage);
        setTimeout(clearError, 2000); // Clear error message after 2 seconds
    }

    function clearError() {
        $("#Expression").text("");
    }

  </script>
</body></html>
```

Script part (4)

Some Output Pictures:-

Supports basic mathematical operations (eg. BODMAS)

OUTPUT



Error: SyntaxError: Invalid left-hand side expression in postfix operation

Error: Division by zero is not allowed.

Error Handling Mechanisms

Limitations

While calculators are incredibly useful tools for performing complex mathematical calculations, they do have certain limitations. Here are some of the limitations of calculators:

1. Lack of Understanding Context: Calculators lack the ability to understand the context in which calculations are being performed. They simply follow predefined algorithms and equations without considering the broader implications or meanings of the calculations.

2.Limited Problem-Solving Skills: Calculators can only solve problems that can be expressed mathematically and have a well-defined solution. They are not capable of solving problems that require critical thinking, creativity, or intuition.

3. Inability to Learn: Calculators do not possess the ability to learn from experience or adapt to new situations. They are programmed with fixed algorithms and functions, and cannot improve or update their capabilities over time.

4. Dependence on User Input: Calculators rely heavily on accurate user input. If the user enters incorrect or incomplete information, the calculator will produce incorrect or incomplete results. Additionally, calculators are susceptible to human error when entering calculations.

5. Lack of Explanation: Calculators often provide numerical results without any explanation or understanding of the underlying concepts. This can make it difficult for users to interpret or verify the accuracy of the results, especially when dealing with complex calculations.

6. Limited Precision: Calculators have a finite number of digits they can display and work with. This can lead to rounding errors or truncation when dealing with calculations involving very large or very small numbers, resulting in less accurate results.

7. Absence of Creativity: Calculators are purely computational devices and do not possess any creative or problem-solving abilities. They cannot come up with

new solutions or approaches to a problem that may require thinking outside the box.

8. Subject to Obsolescence: As technology advances, calculators can become outdated relatively quickly. Newer calculators with more advanced features and capabilities are constantly being developed, rendering older models obsolete.

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Conclusion

In conclusion, the analysis of the calculator code developed using HTML, CSS, and JavaScript highlights its functionality, design, and user interface. The code effectively implements a calculator application with basic arithmetic operations, memory functions, and error handling capabilities.

The HTML elements used in the code, such as <input> and <h1>, provide the necessary structure and display elements for the calculator interface. The CSS styles applied enhance the visual appearance of the calculator, making it visually appealing and user-friendly. The JavaScript functions play a vital role in handling user interactions, performing calculations, and displaying results on the screen.

Overall, the calculator code demonstrates effective utilization of web technologies to create a functional and intuitive calculator application. The design and layout of the calculator provide a seamless user experience, allowing users to perform arithmetic operations accurately and efficiently.

The testing and validation processes conducted on the calculator code have ensured its accuracy, proper functioning, and responsiveness. The unit testing, integration testing, and user acceptance testing have contributed to identifying and addressing any issues or errors. Performance testing has also been carried out to ensure the calculator performs optimally in terms of speed and responsiveness.

While the calculator code is successful in meeting its objectives, there are potential areas for improvement. Further enhancements could include the addition of advanced mathematical operations, scientific notation support, or customization options for the user interface. Continual testing and user feedback can contribute to ongoing refinement and improvement of the calculator application.

Overall, the analysis and evaluation of the calculator code demonstrate the effectiveness of using HTML, CSS, and JavaScript to create a functional and user-friendly calculator application. The code serves as a valuable resource for understanding the implementation of programming concepts in web development and showcases the potential of web technologies in creating practical tools for mathematical calculations.

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