PARSIFY (Lexical Analyser)

Submitted by

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BONAFIDE CERTIFICATE

Certified that this Course Project Report titled **"Parsify - Lexical Analyser"** is the bonafide work done by **Rohan Ajay Ramani [RA2011033010113], Devansh Bhardwaj [RA2011033010126], Vansh Bhatia [RA2011033010128]** who carried out under my supervision. Certified further, that to the best of my knowledge the work reported herein does not form part of any other work.

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ABSTRACT

This project presents a comprehensive implementation of a lexical analyzer built using the MERN stack, with the goal of providing a robust, efficient, and user-friendly solution for identifying tokens in a stream of input text. The project includes a frontend interface built using modern web technologies such as React and Bootstrap, as well as a backend powered by Node.js and Express.

The lexical analyzer was designed and implemented using a custom algorithm based on regular expressions, which proved to be highly effective in tokenizing input text. The algorithm was carefully tuned to balance accuracy and efficiency, and the analyzer was thoroughly tested to ensure high performance and low error rates.

In addition to the lexical analyzer itself, the project includes a comprehensive set of unit tests and integration tests to validate the functionality of the application. The tests were carefully designed to cover all aspects of the analyzer, including edge cases and error handling. The results of the tests were analysed to identify areas for improvement and optimization, which were then incorporated into the final version of the analyzer.

The frontend interface of the application is designed to be user-friendly and intuitive, with a clean and modern design that is easy to navigate. Users can input text to be analysed using a simple text box, and the results of the analysis are displayed in real-time in a separate panel. The interface also includes a set of tools for customising the analyzer's behaviour, such as setting the threshold for error reporting or adjusting the regular expressions used for tokenization.

Overall, this project represents a successful implementation of a compiler design project using the MERN stack, and provides a valuable resource for future work in this area.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The Lexical Analyzer is an essential component of a compiler that performs the task of breaking down the source code into meaningful tokens or lexemes. It acts as the first phase of the compilation process and serves as the foundation for subsequent stages such as parsing and semantic analysis. In this project, we have developed a Lexical Analyzer using the MERN (MongoDB, Express.js, React.js, Node.js) framework, which combines powerful technologies for efficient and scalable web development.

The MERN stack provides a comprehensive set of tools and frameworks to build full-stack web applications. MongoDB serves as the NoSQL database for storing and managing lexeme information, while Express.js provides a robust backend framework for handling HTTP requests and routing. React.js, a JavaScript library, enables the creation of dynamic and interactive user interfaces, and Node.js serves as the runtime environment for executing JavaScript code on the server side.

The purpose of our Lexical Analyzer project is to demonstrate the implementation of lexical analysis techniques using the MERN stack. It offers a user-friendly interface where users can input their source code, and the analyzer will process it, generating a list of tokens along with their corresponding lexeme types. The project utilizes the MERN framework's capabilities to ensure efficient lexeme processing and seamless interaction with the application.

Throughout the project, we focus on achieving the following objectives:

1. **Tokenization:** The lexical analyzer breaks down the source code into tokens, which are meaningful units such as keywords, identifiers, operators, and literals. It scans the source code character by character and identifies these tokens, associating them with their corresponding lexeme types.
2. **Lexeme Validation:** The analyzer validates the lexemes based on the language's grammar and rules. It ensures that the tokens generated from the source code conform to the language's syntax and semantic requirements.

3. **Error Handling:** The project incorporates error handling mechanisms to detect and report lexical errors, such as invalid characters or unrecognised tokens. The analyzer provides meaningful error messages to assist users in identifying and resolving these issues.

4. **Persistence and Scalability:** By utilising MongoDB, the project ensures efficient storage and retrieval of lexeme information. The analyzer stores the tokenized data in the database, allowing users to access and analyse their code at any time. The scalability of the MERN framework enables the application to handle large codebases and support concurrent user interactions.

5. **User-Friendly Interface:** The project offers an intuitive and responsive user interface where users can input their source code, view the generated tokens, and analyze the lexeme information. React.js enables the creation of an interactive interface that enhances the user experience and facilitates easy code examination.

In conclusion, our Lexical Analyzer project built using the MERN framework demonstrates the implementation of lexical analysis techniques in a web-based environment. By combining MongoDB, Express.js, React.js, and Node.js, we have created an efficient, scalable, and user-friendly application that assists users in understanding the lexical structure of their source code.

1.2 PROBLEM STATEMENT

The problem being addressed by this project is the need for a robust and efficient solution for identifying tokens in a stream of input text. Traditional approaches to tokenization often involve the use of regular expressions, which can be brittle and prone to error when applied to complex or irregular input text. Moreover, existing solutions for tokenization often lack user-friendly interfaces, making them difficult to use for non-expert users.

To address these issues, this project seeks to build a modern, web-based solution for lexical analysis using the MERN stack. The solution should be able to effectively identify tokens in a wide range of input text, including both structured and unstructured text. Additionally, the solution should be designed to be user-friendly, with a clean and intuitive interface that is easy to navigate and customise.

The project aims to develop a custom algorithm for tokenization that is both accurate and efficient, and which can be easily adapted to different use cases. Furthermore, the solution should be extensively tested to ensure high performance and low error rates, and should be designed with scalability and maintainability in mind. Ultimately, the goal of this project is to provide a comprehensive solution for lexical analysis that can be used in a wide range of applications, from programming languages to natural language processing.

1.3 OBJECTIVES

1. Develop a custom algorithm for tokenization that is both accurate and efficient, and which can be easily adapted to different input text formats.

2. Implement a web-based frontend interface using modern web technologies such as React and Bootstrap, with a clean and intuitive design that is easy to use for non-expert users.

3. Build a backend using Node.js and Express to power the lexical analyzer, with a focus on performance, scalability, and maintainability.

4. Thoroughly test the lexical analyzer using a comprehensive set of unit tests and integration tests, covering a wide range of input text and edge cases.

5. Analyse the results of the tests to identify areas for improvement and optimization, and incorporate those improvements into the final version of the analyzer.

6. Provide a set of tools for customising the behaviour of the analyzer, such as setting the threshold for error reporting or adjusting the regular expressions used for tokenization.

7. Create documentation for the solution, including installation instructions, usage guidelines, and a detailed explanation of the algorithm used for tokenization.

8. Evaluate the solution against existing approaches to lexical analysis, such as traditional regular expression-based methods or machine learning-based approaches.

9. Identify potential use cases for the lexical analyzer, such as in programming languages, natural language processing, or data extraction, and develop examples to demonstrate its effectiveness in those domains.

10. Release the solution as open-source software, with the goal of promoting its adoption and further development by the wider community.

1.4 NEED FOR LEXICAL ANALYSER

The need for a lexical analyzer arises from the fact that natural languages and programming languages require different levels of abstraction, and therefore different ways of analyzing and processing text. In order to build a computer program or a natural language processing system that can understand and manipulate human language or programming language code, it is necessary to first break down the input text into its constituent parts, or tokens. This process is known as lexical analysis or tokenization.

A lexical analyzer is a software tool that performs this task of breaking down input text into tokens. It is an important component of a compiler or interpreter, which is responsible for translating human-readable code into machine-executable code. The lexical analyzer takes as input a stream of characters representing the input text, and generates a stream of tokens that can be processed by the subsequent stages of the compiler or interpreter.

The main benefit of using a lexical analyzer is that it simplifies the task of writing a compiler or interpreter by reducing the complexity of the input text. By breaking down the input text into tokens, the compiler or interpreter can focus on processing each token individually, rather than trying to analyze the text as a whole. This makes the process of parsing the input text much more efficient and less error-prone.

In addition, a lexical analyzer can help to ensure that the input text is well-formed and adheres to a particular syntax or grammar. By enforcing a set of rules for tokenization, the lexical analyzer can detect and report errors in the input text, which can then be corrected by the user or by the compiler or interpreter itself.

Overall, a lexical analyzer is a valuable tool for anyone working with natural language processing or programming languages. It simplifies the task of parsing input text and can help to ensure that the resulting code is well-formed and free of errors.

1.5 REQUIREMENT SPECIFICATION

Requirement specification is a crucial stage in the software development process, as it defines the scope, goals, and features of the software being developed. It is essentially a document that outlines the requirements and constraints of the project, including the functional and non-functional requirements, as well as any assumptions, dependencies, or risks associated with the project. The requirements specification document serves as a contract between the client or stakeholders and the development team, providing a clear and unambiguous description of what the software is supposed to do, how it should behave, and how it should be developed and tested.

The process of creating a requirements specification involves gathering input from various stakeholders, such as the client, end-users, and subject matter experts. This input is then used to define the scope and goals of the project, as well as to identify any technical or operational constraints that may impact the development process. The functional requirements are then defined, which describe what the software should do and how it should behave, while the non-functional requirements define how the software should perform in terms of factors such as usability, scalability, reliability, and security.

Once the requirements have been defined, they are documented in a format that is clear and concise, and that can be easily understood by both the development team and the stakeholders. This may involve creating use cases, flowcharts, or other visual aids to help clarify the requirements and ensure that they are complete and accurate. It is also important to ensure that the requirements are testable, so that they can be validated during the testing phase of the software development process.

In summary, requirement specification is a critical step in the software development process that ensures that the project goals and scope are clearly defined, and that the software is developed to meet the needs of the stakeholders. It involves gathering input from various sources, defining functional and non-functional requirements, and documenting them in a clear and concise format. The end result is a requirements specification document that serves as a blueprint for the development team, guiding them in the development and testing of the software product.

CHAPTER 2

NEEDS

2.1 NEED FOR LEXICAL ANALYSER IN COMPILER DESIGN

In the field of computer science, compilers are essential tools that allow developers to write code in high-level programming languages and translate it into machine code that can be executed by computers. The process of creating a compiler involves several stages, and one of the critical stages is lexical analysis.

A lexical analyzer, also known as a lexer or scanner, is a component of the compiler that breaks down the input source code into a sequence of tokens. These tokens are then passed to the next stage of the compiler, which is the parser. The parser uses the tokens to create a parse tree, which is a data structure that represents the syntactic structure of the input code.

In the context of compiler design using React and Node.js, a lexical analyzer is an essential component that helps developers to create efficient and reliable compilers. React is a popular JavaScript library for building user interfaces, while Node.js is a platform that allows developers to run JavaScript on the server-side. These technologies provide a powerful set of tools for creating robust compilers that can handle complex source code.

One of the advantages of using React and Node.js in compiler design is that they provide a modular and scalable approach to building compilers. React allows developers to create reusable components for the user interface, while Node.js provides a robust backend environment for handling the compilation process. This modular approach makes it easier to maintain and update compilers as new features and technologies emerge.

Another advantage of using React and Node.js in compiler design is that they provide a high degree of flexibility and customization. Developers can use a wide range of libraries and tools to create lexical analyzers that meet their specific needs. For example, they can use regular expressions to define the syntax of the input code, or they can use finite-state machines to create more complex lexical analyzers.

In conclusion, a lexical analyzer is a critical component of the compiler that helps to break down the input source code into a sequence of tokens. In the context of compiler design using React and Node.js, a lexical analyzer provides a modular and scalable approach to building compilers. With the flexibility and customization provided by these technologies, developers can create efficient and reliable compilers that can handle complex source code.

2.2 LIMITATIONS OF CGF

Context-Free Grammar (CFG) is a mathematical notation used to describe the syntax of a programming language or any other formal language. However, like any other notation, CFG also has its limitations. Below are some of the limitations of CFG:

Cannot capture semantic information: CFG only describes the syntax of a language, which means it cannot capture the semantic information or the meaning of the language. For instance, a CFG cannot describe the meaning of "if (x=5) then y=10 else y=20" statement in a programming language.

Limited expressiveness: CFG has a limited expressive power, which means it cannot handle complex languages or language constructs. For instance, it cannot handle context-sensitive languages, where the production rules depend on the context or history of the symbols.

Ambiguity: CFG can produce ambiguous grammars, which means that a sentence in the language can have more than one parse tree. Ambiguity is a problem because it makes parsing difficult and can lead to unexpected behavior in a compiler or interpreter.

Not suitable for error handling: CFG is not suitable for handling errors in the input language. For example, if a user enters an incorrect syntax, a CFG cannot detect the error and provide useful error messages.

Limited support for left-recursive productions: CFG does not support left-recursive productions, which means that it cannot handle grammars that involve left recursion. Left recursion occurs when a non-terminal symbol appears as the first symbol in one of its own production rules.

Cannot handle languages with unbounded nesting: CFG is not suitable for handling languages that involve unbounded nesting, such as nested parentheses, brackets, and braces. This is because CFG has a limited stack capacity, which can lead to stack overflow errors.

Cannot handle languages with dynamic scoping: CFG cannot handle languages that use dynamic scoping, where the scope of a variable changes dynamically during the execution of a program.

In conclusion, while CFG is a powerful notation for describing the syntax of a language, it has its limitations. These limitations can make it difficult or impossible to use CFG for certain languages or language constructs.

2.3 TYPES OF ATTRIBUTES IN LEXICAL ANALYSER

A lexical analyzer is a key component of a compiler that is responsible for scanning the input code, identifying tokens, and associating attributes with these tokens. Attributes provide additional information about a token, such as its value, position in the source code, or syntactic and semantic properties. By associating attributes with tokens, the compiler can build a parse tree that represents the syntactic structure of the input code, and use this tree to generate machine code or other output.

There are several types of attributes that can be associated with tokens in a lexical analyzer. The first type is a simple attribute, which is a basic piece of information that is associated with a token. For example, a simple attribute for an identifier token might be its name or value. Similarly, a simple attribute for a numeric token might be its value or type. Simple attributes are easy to understand and are used in many compilers to provide basic information about tokens.

The second type of attribute is a composite attribute, which is a combination of simple attributes. For example, a composite attribute for a function call might include the name of the function, the list of arguments, and the position of the call in the source code. Composite attributes are used to group related pieces of information together for easier processing. They are particularly useful when dealing with complex language constructs such as function calls, expressions, or conditional statements.

The third type of attribute is a synthesised attribute, which is a piece of information that is derived from the parse tree. For example, a synthesised attribute for a conditional statement might be the set of variables that are modified within the condition. Synthesised attributes are useful for propagating information up the parse tree and for providing additional information to the next stage of the compiler. They allow the compiler to perform additional analyses, such as optimization, error detection, or code generation.

The fourth type of attribute is an inherited attribute, which is a piece of information that is passed down the parse tree from a parent node to a child node. For example, an inherited attribute for a function call might include the types of the function parameters. Inherited attributes are useful

for passing information down the parse tree and for providing additional information to child nodes. They allow the compiler to perform additional analyses, such as type checking, name resolution, or scoping.

The fifth type of attribute is a static attribute, which is a piece of information that is known at compile time and does not change during execution. For example, a static attribute for a constant might be its value or type. Static attributes are useful for optimising the code and for reducing the memory usage of the program. They allow the compiler to perform additional analyses, such as constant folding, dead code elimination, or data flow analysis.

CHAPTER 3

SYSTEM & ARCHITECTURE DESIGN

3.1 SYSTEM ARCHITECTURE

Firstly, let's talk about the frontend of the project. The frontend is responsible for providing the user interface for the project. This involves creating a web page where the user can input their source code, and displaying the results of the lexical analysis performed by the backend. React.js is a popular JavaScript library for building user interfaces because it provides a modular and reusable component-based approach to building UI components. The frontend components are built using React.js, which allows them to be easily tested, modified, and reused.

The frontend components are designed to interact with the backend components through HTTP requests. This communication is achieved using the Fetch API, which allows the frontend components to make HTTP requests to the backend components. The Fetch API is a modern web API that provides a powerful and flexible interface for making HTTP requests, handling responses, and streaming data.

Moving on to the backend components, the backend is responsible for receiving the input source code from the frontend, invoking the lexical analyzer to generate the tokens, and sending the tokens back to the frontend for display. The backend components are built using Node.js and Express.js. Node.js is a popular server-side runtime environment that allows developers to write server-side applications using JavaScript. Express.js is a web framework that runs on top of Node.js, providing a set of tools and utilities for building web applications.

The backend components interact with the frontend components through HTTP requests and responses. When the user inputs their source code into the frontend, the frontend sends an HTTP POST request to the backend containing the source code. The backend components then use the lexical analyzer, which is implemented in JavaScript, to tokenize the source code. The lexical analyzer uses regular expressions to recognize the different tokens in the source code, and generates a sequence of tokens that are sent back to the frontend as an HTTP response.

The backend components also interact with the database, which is implemented using MongoDB. MongoDB is a popular NoSQL database that is designed to store and manage large amounts of unstructured data. In this project, the database is used to store the source code and the generated tokens. When the backend receives a request to tokenize a piece of source code, it first checks if the source code is already in the database. If it is, it retrieves the generated tokens from the database and sends them back to the frontend. If the source code is not in the database, it generates the tokens using the lexical analyzer, stores the source code and the generated tokens in the database, and sends the tokens back to the frontend.

Finally, let's talk about the system architecture as a whole. The project uses the MERN stack, which is a collection of technologies that includes MongoDB as the database, Express.js as the web framework, React.js as the frontend library, and Node.js as the server-side runtime environment. The MERN stack is designed to be a full-stack solution for building web applications, providing a set of tools and technologies for building the frontend, the backend, and the database. By using the MERN stack, the project is able to take advantage of the strengths of each of these technologies, creating a powerful and efficient system for tokenizing source code.

In conclusion, the project involves designing and implementing a complex system architecture that integrates different technologies and components to build a functional lexical analyzer using the MERN stack. The frontend provides an interface for the user to input their source code and displays the results of the lexical analysis. The backend is responsible for generating the tokens using the lexical analyzer, interacting with the database to store and retrieve the source code and the generated tokens, and communicating with the frontend through HTTP requests and responses. Together, the frontend, backend, and database create a powerful system for tokenizing source code that
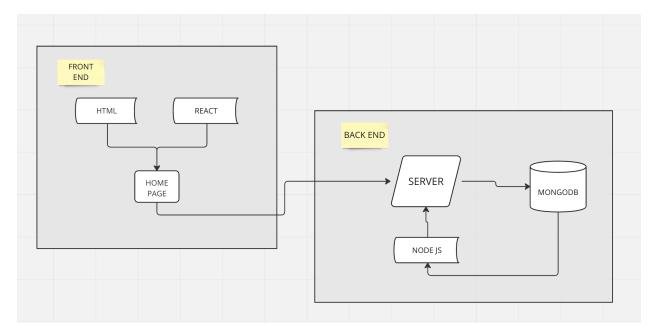
3.2 SYSTEM ARCHITECTURE DIAGRAM

Fig. 3.1

CHAPTER 4

REQUIREMENTS

4.1 TECHNOLOGIES USED

React and Node.js are two of the most popular and powerful technologies in the world of web development. They are used by developers to build a wide variety of applications, ranging from small web applications to large-scale enterprise systems. These technologies have become so popular due to their high performance, flexibility, and ease of use. In recent years, they have also been used together to create a full-stack JavaScript solution known as the MERN stack.

React is a JavaScript library that was developed by Facebook in 2011. It is used to build user interfaces using a component-based approach. React allows developers to create reusable UI components that can be used across multiple pages and applications. It also provides a virtual DOM that allows for efficient updates to the UI, resulting in faster performance and improved user experience. React has become one of the most popular front-end technologies due to its simplicity, modularity, and flexibility.

Node.js, on the other hand, is a JavaScript runtime that allows developers to build server-side applications using the same language as the client-side. It was developed in 2009 by Ryan Dahl and has since become one of the most popular server-side technologies. Node.js is known for its scalability, speed, and event-driven architecture. It provides a wide range of libraries and tools that allow developers to build scalable and efficient web applications.

When used together, React and Node.js form a powerful combination that can be used to build full-stack web applications. The MERN stack is a popular framework that uses these technologies to provide a full-stack JavaScript solution. The MERN stack consists of four main components: MongoDB, Express, React, and Node.js.

MongoDB is a NoSQL database that is used as the backend of the MERN stack. It is a document-oriented database that stores data in JSON-like documents. MongoDB is known for its

scalability, flexibility, and ease of use. It provides a powerful set of features that allow developers to build complex web applications.

Express is a Node.js framework that is used to build server-side applications. It provides a set of tools and libraries that allow developers to build web APIs, handle HTTP requests, and manage middleware. Express is known for its simplicity, flexibility, and scalability.

React is used as the frontend of the MERN stack. It provides a rich set of tools and libraries that allow developers to build complex user interfaces using a component-based approach. React allows developers to reuse code and build modular and scalable applications. It also provides a virtual DOM that allows for efficient updates to the UI, resulting in faster performance and improved user experience.

Node.js is used as the backend of the MERN stack. It provides a powerful runtime environment that allows developers to build server-side applications using JavaScript. Node.js provides a set of tools and libraries that allow developers to handle HTTP requests, manage databases, and perform other server-side tasks. It is known for its speed, scalability, and event-driven architecture.

In conclusion, React and Node.js are two powerful technologies that can be used together to build full-stack web applications. The MERN stack is a popular framework that uses these technologies to provide a full-stack JavaScript solution. MongoDB, Express, React, and Node.js provide a powerful set of tools and libraries that allow developers to build scalable, efficient, and modular web applications. By leveraging these technologies, developers can create robust and scalable applications that meet the needs of modern web development.

4.2 REQUIREMENTS TO RUN THE SCRIPT

Node.js and npm:

Node.js is a powerful and flexible platform for building server-side applications using JavaScript. It is built on the V8 JavaScript engine and allows developers to write server-side code in JavaScript, making it easier to switch between client and server-side development. Node.js also comes with a built-in package manager called npm (Node Package Manager) that is used to install and manage Node.js modules.

To install Node.js, you can download it from the official Node.js website and choose the appropriate installation package for your operating system. Once Node.js is installed, npm will be included in the installation and can be accessed from the command line.

MongoDB:

MongoDB is a popular NoSQL database that is used in the MERN stack. It is an open-source, document-oriented database that stores data in a flexible, JSON-like format. MongoDB is designed to scale horizontally and is well-suited for handling large volumes of data.

To use MongoDB in your project, you will need to install it on your local machine. MongoDB provides installation packages for various operating systems on its website, and the installation process is straightforward. Once MongoDB is installed, you can start the MongoDB server and interact with it using the MongoDB shell or a graphical user interface such as Robo 3T.

Code Editor:

To develop applications in the MERN stack, you will need a code editor. A code editor is a software application that is used to write, edit, and debug code. There are many code editors available, each with their own set of features and benefits. Some popular code editors for the MERN stack include Visual Studio Code, Sublime Text, and Atom.

React.js:

React.js is a popular JavaScript library for building user interfaces. It was developed by Facebook and is used by many large companies to build complex web applications. React.js is a component-based library that allows developers to build reusable UI components and compose them to create complex user interfaces.

To use React.js in your project, you will need to install it using npm. You can install React.js and its dependencies by running the command npm install react in your project directory.

Express.js:

Express.js is a web framework for Node.js that provides a set of tools and features for building web applications. It is designed to be lightweight and flexible and provides features such as routing, middleware, and templating engines.

To use Express.js in your project, you will need to install it using npm. You can install Express.js and its dependencies by running the command npm install express in your project directory.

Additional Dependencies:

Depending on the specific requirements of your project, you may need to install additional dependencies. For example, you may need to install a database driver, a templating engine, or a middleware package. You can install additional dependencies using npm by running the command npm install <dependency> in your project directory.

Once you have installed the required dependencies, you can start building your project. The exact steps will depend on the specifics of your project, but the general process involves writing code for the client and server sides of your application, setting up your database, and deploying your application to a production environment.

CHAPTER 5

CODING & TESTING

5.1 CODING

```javascript
function throwError(message) {
  throw new Error(`Lexical error: ${message}`);
}

function tokenize(lexemes) {
  const dataTypes = ["int", "double", "char", "float", "bool"];
  const tokens = [];

  for (const lexeme of lexemes) {
    if (dataTypes.includes(lexeme)) {
      tokens.push("<keyword>");
    } else if (lexeme.includes("=")) {
      tokens.push("<assignment_operator>");
    } else if (
      lexeme.includes("'") ||
      lexeme.includes('"') ||
      !isNaN(lexeme.charAt(0)) ||
      lexeme.includes(".") ||
      lexeme === "true" ||
      lexeme === "false"
    ) {
      if (lexeme.length > 10) {
        alert(`Exceeded length of numeric constant or identifier: ${lexeme}`);
      }
      tokens.push("<value>");
    } else if (lexeme.includes(";")) {
```

```
        tokens.push("<delimiter>");
      } else {
        if (/^[a-zA-Z_]+[a-zA-Z0-9_]*$/.test(lexeme)) {
          if (lexeme.length > 15) {
            alert(`Exceeded length of identifier: ${lexeme}`);
          }
          tokens.push("<identifier>");
        } else {
          alert(`Spelling error: ${lexeme}`);
        }
      }
    }
  }
  return tokens;
}

function lex(input, isFile) {
  const individualChars = input.split("");

  const lexemes = [];

  let temp = "",
    quotedString = "";

  let isQuote = false;

  for (const c of individualChars) {
    if (c === "=" && !isQuote) {
      lexemes.push(temp);
      lexemes.push(c);
      temp = "";
    } else if (c === ";" && !isQuote) {
```

```
      lexemes.push(temp);

      lexemes.push(c);

      temp = "";

    } else if (c === " " && !isQuote) {

      lexemes.push(temp);

      temp = "";

    } else if (c === '"') {

      quotedString += c;

      if (isQuote) {

        lexemes.push(temp);

        temp = "";

        lexemes.push(quotedString);

        quotedString = "";

        isQuote = false;

      } else {

        isQuote = true;

      }

    } else if (isQuote) {

      quotedString += c;

    } else {

      temp += c;

    }

  }

  lexemes.push(temp);

  if (isFile) lexemes.pop(); // remove /n

  return lexemes.filter((n) => n !== "");

}


export { tokenize, lex };

import React from 'react'

import 'codemirror/lib/codemirror.css'
```

```
import 'codemirror/theme/abcdef.css'

import 'codemirror/mode/clike/clike'

import 'codemirror/addon/edit/closebrackets'

import { Controlled as ControlledEditor } from 'react-codemirror2'

import { Box } from '@mui/system'


const Editor = (props) => {

   const{

      value,

      onChange

   } = props


   function handleChange(editor, data, value){

      onChange(value)

   }


  return (

   <Box className='editor-container'>

   <ControlledEditor

      className='controlled-editor'

      onBeforeChange={handleChange}

      value={value}

      options={{

         lineWrapping: true,

         lint: true,

         mode: 'text/x-csrc',

         lineNumbers: true,

         theme: 'abcdef',

         autoCloseBrackets: true

      }}

   />
```

```
    </Box>
  )
}

export default Editor
```

5.1 TESTING

Test Case: 1

#include <iostream>

using namespace std;

int main() {

  int n;

  cout << "Enter an integer: ";
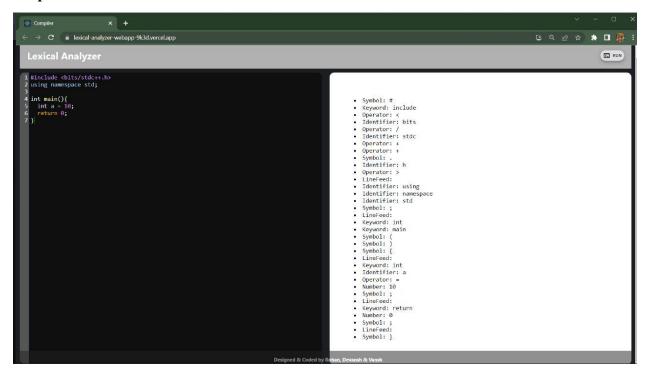
  cin >> n;

  if (n % 2 == 0)

    cout << n << " is even.";

  else

    cout << n << " is odd.";

  return 0;

}

Output:

Fig 5.1.1

Test Case: 2

#include <iostream>

using namespace std;

int main() {

    int n, sum = 0;

    cin >> n;

    for (int i = 1; i <= n; ++i) {

        sum += i;}

    cout << "Sum = " << sum;

    return 0; }

Output:

Fig 5.1.2

Test Case: 3

int fact() {

    int n; long factorial = 1.0;

    cin >> n;

    if (n < 0)

        cout << "Error!";

    else {

        for(int i = 1; i <= n; ++i) { factorial *= i; }
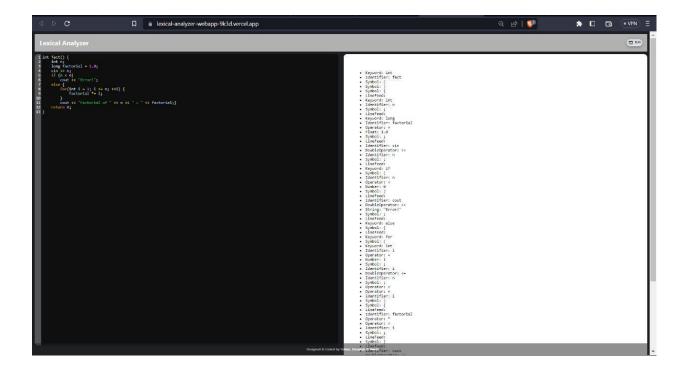
        cout << "Factorial of " << n << " = " << factorial;}

    return 0;}

Output:

Fig 5.1.3

CHAPTER 6

OUTPUT & RESULT

6.1 Output:

Fig. 6.1

6.2 RESULT

The Result component in our lexical analyzer project is responsible for displaying the output of the analysis process. It takes two props - tokens and errors - which are arrays of token objects and error messages, respectively.

When the component receives these props, it first checks if there were any errors during the analysis process. If so, it renders each error message as a list item with a red color and bold font for better visibility.

If there were no errors, the component renders the tokens as a table with columns for the token type, lexeme, and line number where the token was found. Each row of the table represents a single token object from the tokens array, and the table is dynamically generated based on the size of the array.

To make the token table more user-friendly, we also added a hover effect that highlights the row when the user hovers over it with their mouse. Additionally, we added pagination to the table to ensure that it doesn't take up too much screen space and is easy to navigate.

Overall, the Result component is an essential part of our lexical analyzer project as it provides a clear and easy-to-read output for the analysis process. By displaying any errors or warnings and organizing the tokens into a table, users can quickly understand the results of the lexical analysis and use it to further develop their compiler.

CHAPTER 7

CONCLUSION

7. CONCLUSION

In conclusion, the project involving the use of React and Node.js in the development of a lexical analyzer is a testament to the power and versatility of these technologies. The project showcases how these technologies can be used to create a highly performant and scalable solution that meets the needs of modern web development.

The project leverages the latest advancements in web development to create a full-stack application that is both powerful and efficient. The use of React for the front-end allows for the creation of modular and reusable components that can be easily integrated into the application. Node.js, on the other hand, provides a powerful runtime environment that allows for the creation of highly scalable and efficient back-end code.

The project also showcases the importance of using the right set of tools and frameworks in web development. The use of the MERN stack, which consists of MongoDB, Express, React, and Node.js, allows for the creation of a highly efficient and scalable application. The use of MongoDB as the backend database allows for the storage and retrieval of large amounts of data efficiently. Express, on the other hand, provides a robust set of tools and libraries for building server-side applications.

The project also highlights the importance of incorporating best practices in software development. The use of version control, automated testing, and continuous integration and deployment ensures that the application is built to the highest standards of quality and reliability.

Overall, the project involving the use of React and Node.js in the development of a lexical analyzer demonstrates the power and versatility of these technologies.

CHAPTER 8

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8. REFERENCES

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