SER 502 - Class project

Team 5

Programming Language : Kiwi

Team members

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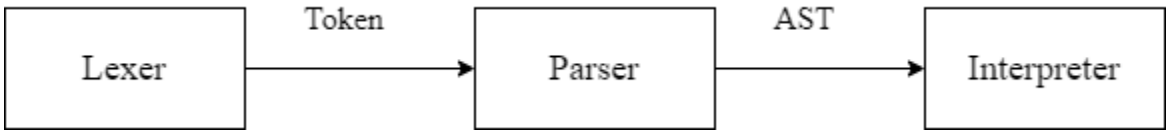
Diagram:



Description:

- Kiwi is an imperative programming language that follows a minimalistic design for writing simple programs.
- The name given to the language emphasizes the simplicity and ease of use of the language.
- It has a syntax that is easy to learn, with familiar constructs for control flow, variables and functions found in most modern programming languages.
- Kiwi also includes a number of built-in data types(numbers, booleans, strings), logic operators(AND, OR, NOT). Additionally, it also supports the ternary operator.

Note: Information below is subject to change in future based on the implementation.

Language Grammar:
Program Structure: A program is composed of a series of functions and a main block containing declarations and commands.

Blocks: A block consists of a series of function definitions followed by a series of declarations and commands. Function definitions are optional and can be omitted if not required.

Declarations: Variables can be declared with a specific data type (let, int, float, or string) and an optional initial value. Ternary expressions can also be used as initial values.

Commands: The language supports various commands, including:

Print command for outputting expressions.
Variable assignment using expressions or ternary expressions.
Conditional statements (if-else) with Boolean expressions.
While loops with a Boolean condition.
For loops with two forms: traditional counter-based loops and range-based loops.
Functions: Functions are defined with a name, input parameters, a block of declarations and commands, and a return statement using the "give" keyword.

Boolean Expressions: Booleans can be represented by true, false, equality comparisons between expressions, or negated Boolean expressions.

Expressions: Expressions can be formed using basic arithmetic operations (addition, subtraction, multiplication, division), parentheses for grouping, variables, or numbers.

Ternary Expressions: The language supports ternary expressions in the form "Identifier == Expression ? Expression : Expression".

Data Types: The language supports four data types: let (for type inference), int, float, and string.

Identifiers: Identifiers are used for naming variables and functions and must begin with a letter or underscore, followed by any combination of letters, digits, or underscores.

Numbers: Numbers are sequences of digits.

Comparisons: Comparison operators include less than, greater than, less than or equal to, greater than or equal to, and equality.

This grammar defines a versatile imperative programming language with support for modern programming constructs such as functions, loops, and conditional statements.

Grammar:

Program ::= Block.

Block ::= Function ; Block | Declaration ; Command.

Declaration ::= Datatype Identifier = Expression ; Declaration | Datatype Identifier ; Declaration | Datatype Identifier = Ternary ; Declaration | Φ

Command ::= print Expression ; Command |
    Identifier = Expression ; Command |
    Identifier = Ternary ; Command |
    if Boolean { Command } else { Command } ; Command |
    while Boolean { Command } ; Command |
    for (Identifier = Expression ; Identifier Comparison Expression ; Identifier Update) { Command } ; Command |
    for Identifier in range (Expression, Expression) { Command } ; Command | Φ

Function ::= fn Identifier : (Identifier, Identifier) { Declaration ; Command ; give Expression }

Boolean ::= true | false | Expression == Expression | not Boolean

Expression ::= Expression + Expression | Expression - Expression | Expression * Expression | Expression / Expression | (Expression) | Identifier | Number

Ternary ::= Identifier == Expression ? Expression : Expression

Datatype ::= let | int | float | string

Identifier ::= [a-z A-Z_][a-z A-Z 0-9_]*

Number ::= Digit Number | Digit

Digit ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

Comparison ::= < | > | <= | >= | ==

Components:

1. Lexical Analyzer

- The lexical analyzer is responsible for reading the input Kiwi program and converting it into a stream of tokens.
- We plan to implement the lexical analyzer using the ANTLR.
- The stream of tokens will be an input to the parser program again implemented using ANTLR.

2. Parser

- The parser of the Kiwi programming language will be implemented using ANTLR.
- It will be a Definite Clause Grammar(DCG) for the Backus Naur Form(BNF) Grammar written above.
- It is responsible for checking the syntax of the Kiwi program and generates the parse tree.
- The output to the parser is an abstract syntax tree which will be converted to an intermediate code which will be passed as input to the interpreter.

3. **Interpreter**

- The interpreter is responsible for executing the code that has been parsed and translated into an intermediate form, such as an abstract syntax tree.
- The interpreter will walk through the intermediate form and execute each node, producing a result.
- It will take in the parsed code, which has been translated into an abstract syntax tree, and walk through the tree, executing each node and producing a result.
- It will handle tasks like Variable management, Expression evaluation, Control flow, and Input/Output.
- The interpreter will be implemented in Python and will use the Python interpreter to execute the intermediate form of the code.