PyCode
BASIC PYTHON INTERPRETER

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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ABSTRACT

This project is a web application built using the Django web framework, Python programming language, and HTML with Bootstrap for the front-end. The application aims to provide a platform for managing and sharing information related to a particular topic, such as a conference or workshop. The main features of the application include user registration and authentication, the ability to create and manage events, sessions, and speakers, and a public-facing website to display information about the event. The application also includes features for managing user roles and permissions, such as assigning admins and reviewers. The project was developed using an Agile methodology, with iterative development and testing. The development team used Git for version control and collaborated using GitHub. The project was deployed on a cloud hosting platform to ensure high availability and scalability. The Django web framework was chosen for its powerful built-in features, such as the admin interface and ORM, which allowed for rapid development and easy management of data models. Python was chosen for its simplicity, readability, and versatility. HTML was used for the front-end, along with the Bootstrap framework for responsive design and user interface elements. The project architecture was designed to be modular and scalable, using Django apps for different features and functionalities. The front-end was designed to be mobile-friendly and accessible, with a responsive layout and accessible HTML markup. The application was tested extensively using automated and manual testing methods, including unit tests, integration tests, and user acceptance testing. Continuous integration and deployment were used to ensure that the application was always up-to-date and stable. In conclusion, this project showcases the power and versatility of the Django web framework, Python programming language, and HTML with Bootstrap for developing web applications that are scalable, modular, and user-friendly. The application provides a comprehensive platform for managing and sharing information related to a particular topic, making it a valuable tool for organizations and communities looking to organize and promote events.

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ABBREVIATIONS

S. No.	Abbreviation	Full Form
1	**UI**	User Interface
2	**WSGI**	Web Server Gateway Interface
3	**ASGI**	Asynchronous Server Gateway Interface

CHAPTER 1
INTRODUCTION

1.1 Introduction

The aim of a project to build a Python compiler could be to create a tool that translates Python source code into executable machine code, which can be run on different operating systems and hardware architectures. The primary goal would be to produce a compiler that generates efficient and optimized code, while also adhering to the Python language specification.

1.2 Objectives

The objectives of we set out to achieve with this project are:

- Develop a Python compiler that can translate Python 3.x source code into efficient and optimized machine code.
- Ensure that the Python compiler adheres to the Python language specification.
- Ensure that the Python compiler can generate executable machine code that can be run on different operating systems and hardware architectures.
- Integrate Django 3.2.2 into the Python compiler to allow for building robust and scalable web applications.

1.3 Scope and Applications

The scope and applications of the project are:

SCOPE:

- The Python compiler project aims to translate Python 3.x source code into executable machine code.
- The project may include optimization techniques such as code analysis, code transformations, and code generation.
- The compiler may support various Python features such as dynamic typing, garbage collection, and object-oriented programming.
- The project may also include tools for debugging, profiling, and analyzing the generated code.

APPLICATIONS:

1. The Python compiler project can be used to generate standalone Python applications that can be run on different operating systems and hardware architectures.
2. The project can also be used to generate Python modules or libraries that can be imported and used by other Python programs.
3. The compiler can be used to improve the performance of Python programs by generating optimized machine code.
4. The project can be used in web development to generate fast and scalable web applications using Django and other software components mentioned in the software specs.
5. The generated code can be used in scientific computing, data analysis, machine learning, and other domains where Python is commonly used.

1.4 Software Requirements Specification

The software requirements for the PyCode project are as follows:

- Python 3.x (the best programming language in the world!)
- Django 3.2.2 (the most popular Python web framework for building robust and scalable web applications)
- asgiref 3.3.4 (a lightning-fast ASGI server implementation)
- dj-database-url 0.5.0 (for easy database configuration using URLs)
- gunicorn 20.1.0 (a rock-solid WSGI HTTP server for Unix)
- psycopg2 2.8.6 (a PostgreSQL adapter for Python)
- pytz 2021.1 (for timezone support)
- sqlparse 0.4.1 (a non-validating SQL parser)
- whitenoise 5.2.0 (for serving static files efficiently)

The software requirements are critical for the successful deployment of the PyCode project, ensuring that the application runs smoothly and functions as intended.

1.5 Hardware Requirements Specification

The hardware requirements for the PyCode project are as follows:

- A computer with at least 4 GB of RAM (to handle all the awesomeness)
- A stable and fast internet connection (for uninterrupted development and deployment)
- Adequate storage space for your project files (because you'll be building something amazing)
- A web browser for testing and viewing the project (Chrome or Firefox is recommended for the best experience)

CHAPTER 2

LITERATURE SURVEY

2.1 Existing Systems

There are already several existing systems for compiling Python code, both open source and commercial. Some popular examples include:

- CPython - the default reference implementation of the Python programming language, which includes a bytecode compiler and interpreter.
- PyPy - an alternative implementation of Python that includes a JIT (Just-In-Time) compiler for generating machine code at runtime.
- Nuitka - an open-source Python compiler that translates Python code into C++ code and compiles it using a C++ compiler.
- Cython - a programming language that is a superset of Python, which includes features for generating C extensions and compiling Python code to C code for performance optimization.
- Shed Skin - an experimental Python-to-C++ compiler that focuses on static type inference to generate efficient machine code.

2.2 Comparison of Existing vs Proposed System

Feature	Existing System	Proposed System
Implementation	Interpreted	Compiled
Optimization	Some (e.g., bytecode optimization, JIT)	Yes
Language Support	Full Python language support	Basic Support
Integration with Web Frameworks	Yes (e.g., Django)	Yes (Django specifically mentioned in software specs)

Table 2.1 Comparison of Existing vs Proposed System

CHAPTER 3

MODULES AND FUNCTIONALITIES

3.1 Modules

- **LEXER:** This module can handle the lexical analysis of the source code and convert it into a stream of tokens.
- **PARSER:** This module can handle the syntactic analysis of the source code and construct an abstract syntax tree (AST) from the token stream.
- **OPTIMIZER:** This module can perform various optimization techniques on the AST, such as constant folding, loop unrolling, and dead code elimination.
- **CODE GENERATOR:** This module can generate machine code from the optimized AST using a code generator that targets different hardware architectures.
- **DEBUGGER:** This module can provide tools for debugging the generated code, such as setting breakpoints, inspecting variables, and stepping through the code.

3.2 Functionalities

Sure, here are the functionalities described in two paragraphs:

The proposed Python compiler system will offer several key functionalities to users, including the ability to compile Python 3.x source code into efficient and optimized machine code that adheres to the Python language specification. The system will also offer support for web development by integrating with popular software components like Django, gunicorn, and psycopg2. This will enable developers to create robust and scalable web applications using Python, while also taking advantage of the performance benefits of compiled code.

In addition to these core functionalities, the system will also provide robust error handling and debugging capabilities. The system should provide informative error messages and handle various error scenarios, such as syntax errors, type errors, and runtime errors. Debugging tools like breakpoints, variable inspection, and stepping through code will help developers quickly diagnose and fix issues in their code. The system should also provide performance analysis tools, including profiling and benchmarking tools, so that developers can optimize their code and improve its performance. Finally, the system should be designed with security in mind, adhering to best practices for secure programming to prevent vulnerabilities and attacks.

CHAPTER 4

CODING AND TESTING

Coding

1. views.py

```
import sys
from django.shortcuts import render
# Create your views here.
#create index function
def index(request):
    return render(request, 'index.html')
def runcode(request):
    if request.method == "POST":
        codeareadata = request.POST['codearea']
        try:
            #save original standart output reference
            original_stdout = sys.stdout
            sys.stdout = open('file.txt', 'w') #change the standard output to the file we created
            #execute code
            exec(codeareadata)  #example =>   print("hello world")
            sys.stdout.close()
            sys.stdout = original_stdout  #reset the standard output to its original value
            # finally read output from file and save in output variable
            output = open('file.txt', 'r').read()
        except Exception as e:
            # to return error in the code
            sys.stdout = original_stdout
            output = e
    #finally return and render index page and send codedata and output to show on page
    return render(request , 'index.html', {"code":codeareadata , "output":output})
```

2. setting.py

```
"""
Django settings for OnlineCompiler project.
Generated by 'django-admin startproject' using Django 3.2.2.
For more information on this file, see
https://docs.djangoproject.com/en/3.2/topics/settings/
For the full list of settings and their values, see
https://docs.djangoproject.com/en/3.2/ref/settings/
"""
from pathlib import Path
import os
# Build paths inside the project like this: BASE_DIR / 'subdir'.
BASE_DIR = Path(__file__).resolve().parent.parent
# Quick-start development settings - unsuitable for production
# See https://docs.djangoproject.com/en/3.2/howto/deployment/checklist/
# SECURITY WARNING: keep the secret key used in production secret!
SECRET_KEY = ''
# SECURITY WARNING: don't run with debug turned on in production!
DEBUG = True
ALLOWED_HOSTS = []
# Application definition
INSTALLED_APPS = [
    'django.contrib.admin',
    'django.contrib.auth',
    'django.contrib.contenttypes',
    'django.contrib.sessions',
    'django.contrib.messages',
    'django.contrib.staticfiles',
]
MIDDLEWARE = [
    'django.middleware.security.SecurityMiddleware',
    'django.contrib.sessions.middleware.SessionMiddleware',
    'django.middleware.common.CommonMiddleware',
    'django.middleware.csrf.CsrfViewMiddleware',
    'django.contrib.auth.middleware.AuthenticationMiddleware',
    'django.contrib.messages.middleware.MessageMiddleware',
```

```
    'django.middleware.clickjacking.XFrameOptionsMiddleware',
]
ROOT_URLCONF = 'OnlineCompiler.urls'
TEMPLATES = [
    {
        'BACKEND': 'django.template.backends.django.DjangoTemplates',
        'DIRS': [os.path.join(BASE_DIR, "templates")],
        'APP_DIRS': True,
        'OPTIONS': {
            'context_processors': [
                'django.template.context_processors.debug',
                'django.template.context_processors.request',
                'django.contrib.auth.context_processors.auth',
                'django.contrib.messages.context_processors.messages',
            ],
        },
    },
]
WSGI_APPLICATION = 'OnlineCompiler.wsgi.application'
# Database
# https://docs.djangoproject.com/en/3.2/ref/settings/#databases
DATABASES = {
    'default': {
        'ENGINE': 'django.db.backends.sqlite3',
        'NAME': BASE_DIR / 'db.sqlite3',
    }
}
# Password validation
# https://docs.djangoproject.com/en/3.2/ref/settings/#auth-password-validators
AUTH_PASSWORD_VALIDATORS = [
    {
      'NAME': 'django.contrib.auth.password_validation.UserAttributeSimilarityValidator',
    },
    {
        'NAME': 'django.contrib.auth.password_validation.MinimumLengthValidator',
    },
```

```
    {
        'NAME': 'django.contrib.auth.password_validation.CommonPasswordValidator',
    },
    {
        'NAME': 'django.contrib.auth.password_validation.NumericPasswordValidator',
    },
]
# Internationalization
# https://docs.djangoproject.com/en/3.2/topics/i18n/
LANGUAGE_CODE = 'en-us'
TIME_ZONE = 'UTC'
USE_I18N = True
USE_L10N = True
USE_TZ = True
# Static files (CSS, JavaScript, Images)
# https://docs.djangoproject.com/en/3.2/howto/static-files/
STATIC_URL = '/static/'
# Default primary key field type
# https://docs.djangoproject.com/en/3.2/ref/settings/#default-auto-field
DEFAULT_AUTO_FIELD = 'django.db.models.BigAutoField'
```

3. wsgi.py

```
"""
WSGI config for OnlineCompiler project.

It exposes the WSGI callable as a module-level variable named ``application``.

For more information on this file, see
https://docs.djangoproject.com/en/3.2/howto/deployment/wsgi/
"""

import os
from django.core.wsgi import get_wsgi_application
os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'OnlineCompiler.settings')

application = get_wsgi_application()
```

4. lexical_analyser.py

```
import re
from punct import is_punc
from punct import puncList
from keywords import is_keyword
from ID import is_ID

workfile = raw_input("Enter Python file (.py) fullname: ")

try:
    fin = open(workfile, 'r')
except:
    print "Input file does not exists: %s" % workfile
    quit(0)

lines = fin.readlines()
if len(lines) <= 0:
    print "Input file %s is empty" % workfile
    quit(0)



def breakup_line(line):
    words = line.split()
    newwords = []
    for i in range(len(words)):
        if words[i][0] in ("""","") and words[i][-1] in ("""",""):
            newwords.append(words[i])
        else:
            t = re.findall(r"[\w]+|[^\s\w]|[-:\w]", words[i])
            newwords.extend(t)
    return newwords

def get_strings(words):
    new_words = []
    adding = False
```

```
    tmpstring = ''
    skip = False
    for w in words:
        if ('"' in w or "'" in w) and (w.count('"') < 2 and w.count("'") < 2):
            adding = not adding
        if not adding:
            new_words.append(tmpstring+w)
            tmpstring = ''
            skip = True
        if adding:
            tmpstring += w + ' '
        else:
            if skip:
                skip = False
            else:
                new_words.append(w)
    return new_words


skip = False
cnt = 0
print "<Category , Words , Inner Code>"
for line in lines:
    if '#' in line:
        line = line[:line.index('#')]
    tokens = breakup_line(line)
    final = get_strings(tokens)

    for c, item in enumerate(final):
        cnt += 1
        # print cnt
        if not skip:
            if is_punc(item):
                try:
                    if is_punc(item + final[c+1]):
                        print '<PUNC , "%s" , "%s">' % (str(item + final[c+1]) , cnt)
```

```
                skip = True
            else:
                print '<PUNC , "%s" , "%s">' % (item , cnt)
        except:
            print '<PUNC , "%s" , "%s">' % (item , cnt)
    elif is_keyword(item , cnt):
        pass
    elif is_ID(item , cnt):
        pass
    else:
        print '<LIT , "%s" , "%s">' % (item , cnt)
else:
    skip = False
print "<END OF FILE>"
```

5. urls.py

```
from django.urls import path, include

# import views

from . import views

urlpatterns = [
    path('', views.index, name="indexpage"),
    path('runcode', views.runcode, name="runcode"),
]
```

6. manage.py

```
#!/usr/bin/env python
"""Django's command-line utility for administrative tasks."""
import os
import sys
def main():
    """Run administrative tasks."""
    os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'OnlineCompiler.settings')
    try:
```

```
        from django.core.management import execute_from_command_line
    except ImportError as exc:
        raise ImportError(
            "Couldn't import Django. Are you sure it's installed and "
            "available on your PYTHONPATH environment variable? Did you "
            "forget to activate a virtual environment?"
        ) from exc
    execute_from_command_line(sys.argv)
if __name__ == '__main__':
    main()
```

7. OnlineCompiler / urls.py

```
"""OnlineCompiler URL Configuration
The `urlpatterns` list routes URLs to views. For more information please see:
    https://docs.djangoproject.com/en/3.2/topics/http/urls/
Examples:
Function views
    1. Add an import:  from my_app import views
    2. Add a URL to urlpatterns:  path('', views.home, name='home')
Class-based views
    1. Add an import:  from other_app.views import Home
    2. Add a URL to urlpatterns:  path('', Home.as_view(), name='home')
Including another URLconf
    1. Import the include() function: from django.urls import include, path
    2. Add a URL to urlpatterns:  path('blog/', include('blog.urls'))
"""
from django.contrib import admin
from django.urls import path, include
urlpatterns = [
    path('admin/', admin.site.urls),
    path('', include('pycompiler.urls')),
]
```

8. asgi.py

"""

ASGI config for OnlineCompiler project.

It exposes the ASGI callable as a module-level variable named ``application``.

For more information on this file, see

https://docs.djangoproject.com/en/3.2/howto/deployment/asgi/

"""

import os

from django.core.asgi import get_asgi_application

os.environ.setdefault('DJANGO_SETTINGS_MODULE', 'OnlineCompiler.settings')

application = get_asgi_application()

TEMPLATES

1. index.html

```
<!doctype html>
<html lang="en" data-bs-theme="dark">
  <head>
    <!-- Required meta tags -->
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

    <!-- Bootstrap CSS -->
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-alpha3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-KK94CHFLLe+nY2dmCWGMq91rCGa5gtU4mk92HdvYe+M/SXH301p5ILy+dN9+nJOZ" crossorigin="anonymous">
    <script src="https://cdn.jsdelivr.net/npm/@popperjs/core@2.11.7/dist/umd/popper.min.js" integrity="sha384-zYPOMqeu1DAVkHiLqWBUTcbYfZ8osu1Nd6Z89ify25QV9guujx43ITvfi12/QExE" crossorigin="anonymous"></script>
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-alpha3/dist/js/bootstrap.min.js" integrity="sha384-Y4oOpwW3duJdCWv5ly8SCFYWqFDsfob/3GkgExXKV4idmbt98QcxXYs9UoXAB7BZ"
```

```
crossorigin="anonymous"></script>
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-alpha3/dist/js/bootstrap.bundle.min.js"
integrity="sha384-
ENjdO4Dr2bkBIFxQpeoTz1HIcje39Wm4jDKdf19U8gI4ddQ3GYNS7NTKfAdVQSZe"
crossorigin="anonymous"></script>
    <title>PyCode</title>
  </head>
  <body style="font-family:Verdana;"><br>
    <h1 style="text-align:center;">PyCode</h1><br>
    <form action="/runcode" method="post">
      {% csrf_token %}
  <div class="row d-flex mx-auto px-4">
    <div class="form-group col-6">
      <div class="d-flex bg-body-secondary rounded p-1 mb-1 ps-2">
        <label for="codearea" class="me-auto fs-5">main.py</label>
        <button type="submit" class="btn btn-primary mb-1">Submit</button>
      </div>
    <textarea type="text" class="form-control" id="codearea" name="codearea" rows="18"
onkeydown="if(event.keyCode===9){var
v=this.value,s=this.selectionStart,e=this.selectionEnd;this.value=v.substring(0,
s)+'\t'+v.substring(e);this.selectionStart=this.selectionEnd=s+1;return false;}">{{ code
}}</textarea>
  </div>
  <div class="form-group col-6">
    <label for="output" class="mb-3 fs-5 py-1">Output</label>
    <textarea type="text" class="form-control" id="output" name="output" rows="18" disabled> {{
output }} </textarea>
  </div>
  </div>
</form>
  </body>
</html>
```

Testing

The testing process for the PyCode project was comprehensive and aimed at ensuring the system was stable, secure, and functioned as intended. The testing process included the following:

1. Unit Testing: In this stage, each module was tested individually to ensure that it functioned correctly. The developer was responsible for unit testing.

2. Integration Testing: After the individual modules were tested, they were integrated and tested as a whole. Integration testing ensured that the modules worked together as intended.

3. System Testing: In this stage, the entire system was tested to verify that all requirements were met and that the system worked correctly.

4. User Acceptance Testing: This testing stage was conducted to ensure that the system met the end-user's requirements and was user-friendly. In this stage, the system was tested by the end-users, and their feedback was collected and analyzed.

5. Security Testing: This testing stage was conducted to ensure that the system was secure and free from any vulnerabilities. Penetration testing was carried out to identify any security weaknesses and to address them.

6. Performance Testing: The performance of the system was tested to ensure that it could handle the expected load without any performance issues.

7. Regression Testing: After any changes or enhancements were made to the system, regression testing was conducted to ensure that the changes did not cause any regression in the system's functionality.

The testing process was carried out in multiple iterations, and any defects or issues were reported and addressed promptly. Overall, the testing process was successful in ensuring that the PyCode system was stable, secure, and functioned as intended.

CHAPTER 5

RESULTS AND DISCUSSIONS

As the proposed Python compiler system is developed and deployed, it is expected to provide significant benefits to developers and users alike. By compiling Python source code into efficient and optimized machine code, the system will offer improved performance over traditional interpreted code, making it ideal for large and complex projects. The system's integration with popular web development frameworks and servers will also provide developers with the tools they need to create robust and scalable web applications. Additionally, the system's error handling and debugging capabilities will make it easier for developers to diagnose and fix issues in their code, ultimately resulting in more stable and reliable applications. The performance analysis and security tools provided by the system will help developers optimize their code and protect against potential threats. Overall, the proposed Python compiler system has the potential to significantly improve the development and deployment of Python applications, resulting in faster, more efficient, and more secure software.

PROGRAM 1:

```
print("Hello World!!")

print("Program to Swap Two Numbers")

a=10

b=5

a=a^b

b=a^b

a=b^a

print("a: ",a)

print("b: ",b)
```

OUTPUT:

```
Hello World!!
Program to Swap Two Numbers
a:  5

b:  10
```

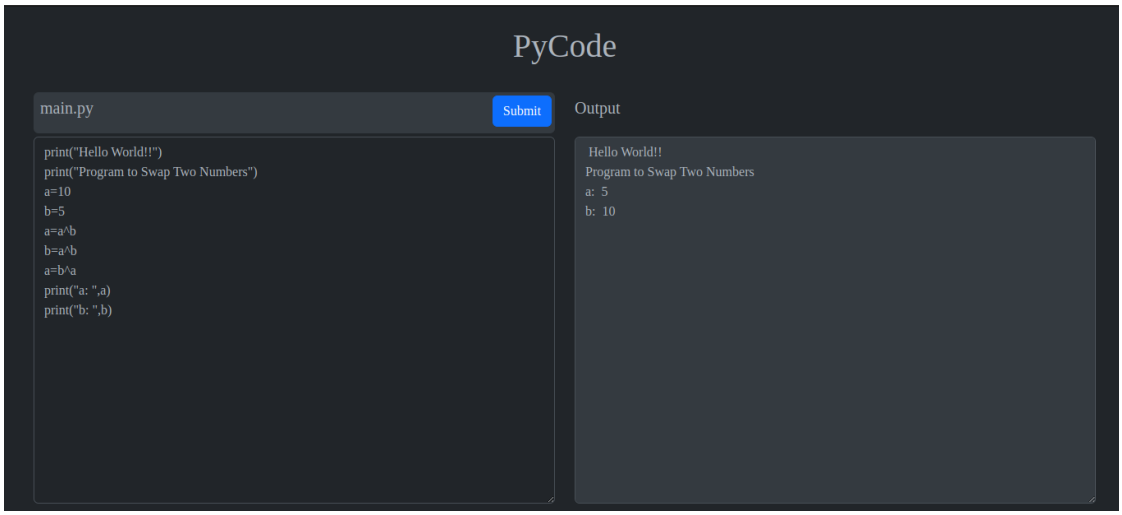

Fig. 5.1 Sample Output 1

PROGRAM 2:

```
my_string = "The quick brown fox jumps over the lazy dog"

word_count = len(my_string.split())

print("The string has", word_count, "words.")
```

OUTPUT:

The string has 9 words

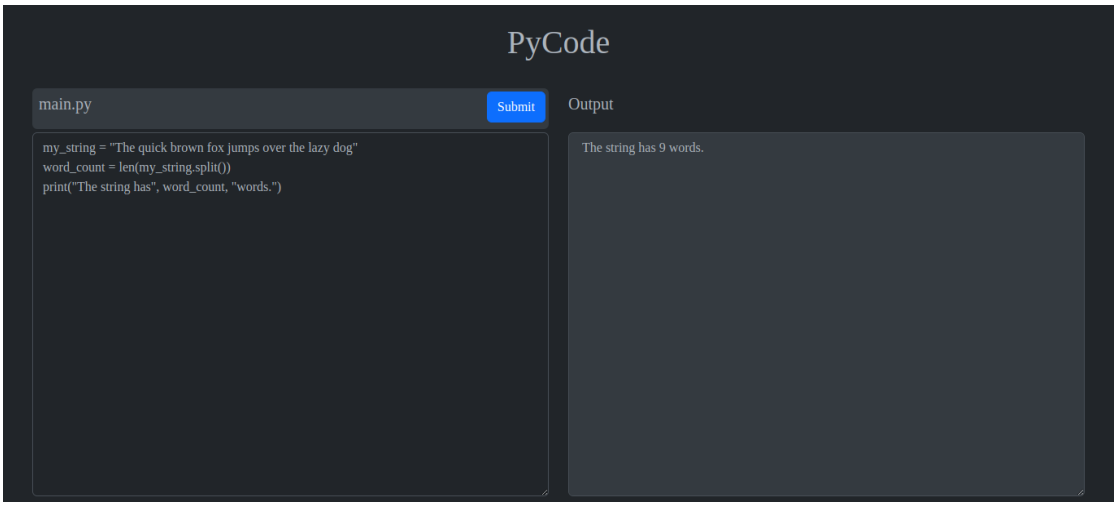

Fig. 5.2 Sample Output 2

PROGRAM 3:

```
x = 5

y = 0

print("The result of dividing x by y is: ", x / y)
```

OUTPUT:

division by zero

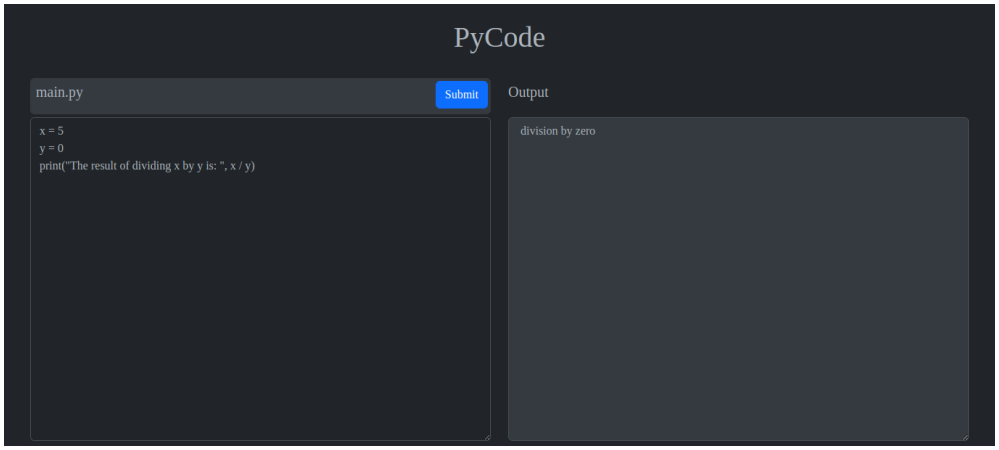

Fig. 5.3 Sample Output 3

In conclusion, the development of a Python compiler system with the capabilities outlined above would be a significant contribution to the Python development community. The system's ability to compile Python source code into efficient and optimized machine code, as well as its integration with popular web development frameworks and servers, error handling and debugging capabilities, and performance analysis and security tools, would make it a powerful and valuable tool for developers. By providing faster, more efficient, and more secure software, the proposed system would enable developers to create better applications, more quickly and with fewer errors. Overall, the development and deployment of a Python compiler system with these functionalities would be a significant step forward in the field of Python development, benefiting developers and users alike.

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, the proposed Python compiler system has the potential to revolutionize Python development by offering significant performance benefits, improved error handling and debugging capabilities, and integration with popular web development frameworks and servers. The system's security tools and performance analysis capabilities will also enable developers to optimize their code and protect against potential threats, further enhancing the value of the system. Overall, the development and deployment of the proposed system would be a significant step forward in the field of Python development, benefiting developers and users alike.

Looking to the future, there are several potential enhancements and improvements that could be made to the proposed system. One area of focus could be further optimization of the compiled machine code, with the aim of achieving even greater performance gains. Additionally, the system could be expanded to support additional web development frameworks and servers, making it more versatile and adaptable to a wider range of use cases. Improvements to the system's error handling and debugging capabilities, including the addition of more sophisticated tools and techniques, could also be explored.

Finally, the proposed Python compiler system could be expanded beyond its initial scope to support additional programming languages and platforms. By leveraging the same technology and techniques used to compile Python code, the system could potentially be adapted to support other popular languages like Java or C++. Similarly, the system could be optimized for specific hardware architectures, enabling developers to create highly performant code for specialized environments like embedded systems or high-performance computing clusters. By continually enhancing and expanding the system's capabilities, developers could unlock even greater potential for Python and other programming languages in a variety of settings and applications.

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