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PYTHON & DJANGO THE FASTEST GROWING WEB DEVELOPMENT TECHNOLOGY

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Abstract - This paper spreads the knowledge of Python and Django for World Wide Web site development. Web development can be defined as the process involved in building, creating and maintaining a website for internet or intranet. It involves front-end and back-end. HTML, CSS, JS, Bootstrap framework etc. are some languages used to develop front-end whereas Python, PHP, Java etc. are some languages used to develop back-end. During the development of a website, the appearance of the website makes the development more critical. A good website can easily attract a large number of successful web visitors. In order to design and enhance good layout and good web design we must choose the right technology. The technical requirements for satisfying a good website can be fulfilled by "Python" with "Django". Python is fastest growing language but one area where python shines the most is web development, it offers many frameworks like Django, Flask, Pyramid, Bottle.py, web2py. Django, a Python's free to use web framework making development easy and time saving. The patter that Django follows is Model- View-Controller (MVC) architecture. Python offers more flexibility, security, high performance, easy to use, simple syntax over PHP, this is the reason why python is fastest growing language.

***Index Terms*—Django, Python Framework, Web Development, MVC**

I. INTRODUCTION

Python is one of the most extensively accepted, targeted, restated, and extensively used languages, and its design gospel emphasizes reading the law through critical reclamation. Its language- grounded approach helps program itineraries code clear and logically law for any kind of systems. It has extreme large community and huge library support [1]. This language aims to provides a good kick start for newcomers and many newcomers in technology using Python as their introductory background mound. Over the once many times, Python has exploded in fissionability and Python's operation has grown exponentially [2]. The programming language has surpassed Java in fissionability, but, for numerous, this isn't surprising. With the growth of machine literacy, data analysis, and web operation development, numerous inventors are using Python and its important and protean libraries, easy-to-read, and movable syntax. Python can be used to make web operations near a garcon. While a web frame isn't needed to make web operations, it isn't uncommon for inventors to use being open- source libraries to accelerate their progress in making their operations work.

Python isn't used in the web cyber surfed. The language used in cyber surfs like Chrome, Firefox and Internet Explorer is JavaScript. Systems like pyjs can integrate from Python to JavaScript [3].

Django is a free Python- grounded web frame with open source following architecture pattern model-template design developed and maintained by the Django Software Foundation. This frame uses MVT design structure. Because of its rapid-fire development point. Django is in high demand in the current request. It takes a little time to make any kind of operation. Why do we call this Model View template because this frame will work predicated on the model as a website and look like a control function and the template will act as the user side in communication? This model will serve as an information operation tool, using two crucial features. Commands similar as pythonmanage.py make migration. Django will make changes to themodel.py train and is ready to shoot data to sqlite3 (elect any website). Also let the pythonmanager.py go. Also, when a programmer do one further Pythonmanage.py run garcon command in the end this will start our design and give us an original design that works locally. Also, theview.py train will manage the design operation in the operation API operation template. We can write ideas in the form of python functions.

In this digital age [4], the availability of diversity resources for various digital machines makes our lives simple. In the field of development also, there are many different options available to develop web site but going with Python and Django make development simple and fast. It promotes rapid development as well pure, pragmatic design. The front-end is mostly common with all development language but the background contains Python, Django, SQLite and their libraries and frameworks. The advent of internet has greatly influenced the way of shopping. So far most of the users prefer to shop online rather instead of doing it in offline markets. That's why I've implemented an ecommerce project based on Python and Django to show their working. This project provides facilities to the user to do shopping along with news sections online on web using Mobile, Tablet, and Computer. Ecommerce refers to any online sale. In online marketing, e-commerce software on the web garcon allows

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callers to the online point to elect particulars that will ultimately be bought. Atlete Purchase has all the needed modules including stoner enrolment, profile operation, shopping wain, wish list, and order history [5]. The software allows online guests to collect a shopping list, which is figuratively described as a “wain” or “add to tote.” Formerly out, the software generally calculates the total quantum of the order, including shipping and running costs (i.e., shipping and packaging) and associated levies, as applicable.

The design area has been made easier to use with proper use of Hyper Text Markup Language, Cascading Style Sheet, JavaScript and Bootstrap. Anthologized in Python editing language. Python web development is really popular because of its learnedness and performance. We easily pierce numerous multi-line legal services using Python. Python used for development process that includes security issues concern. The web app is easy to use and easy to use. This design will help the most talented people in their diurnal lives. Python is much more secure than utmost programming languages. The development process followed the Repeated Software Development Model. The idea was to add functionality and design, testing and performance. Although this system takes new boxes but with each background duplication it takes lower time to develop and with the help of this system, crime is detected and fixed at the same time.

The feasibility work of the design helped fetching the main objects to wit

- Variety of Product and category.
- Different Subcategories within each Main Category.
- Blogging facility to the site.
- Registration and Login to the site.
- News facility to the site (Using external APIs).
- Easy backend management.
- Contact us page for easy communication between user and admin of the site.
- Payment gate implementation.

Project evaluation is done using two methodologies of acquiring information. Black Box check by freaks. Feedback was recorded and emendations were made as needed; and White Tests A box in which different test cases are performed by the source law unit and tested. Freaks are requested to run the design and test all features [21]. In each test case, the product was anticipated. Each error has been removed from the source rule and all units are eventually included. Django is extensively accepted and used by many organizations and sites:

- Disqus Instagram.
- Knight Foundation. MacArthur Foundation.
- Open Knowledge Foundation. Pinterest.
- Mozilla.
- National Geographic

II. Literature Survey

From project development to project deployment, multihued tools and technologies were used. Some of the tools used in development and distribution are bandied in this paper briefly. Also, there various research paper and books has been published over the internet here are some of them:

William S. et al: This paper is about web development using Python and Django using a project-based development learning process using Python and its framework, namely, Django. This book contains five projects in total that will help you to read it with a lot of practice. Starting with the newspaper app hello. [1], [22], [33] and [34].

Wesley Chun, Jeff Forcier, Paul Bissex - Web Development with Python and Django: This paper is about building a dynamic web application using the Django Python frame- work. [2], [24]

Carl Burch; Django, Anaconda Framework: In this paper Carl briefly describes the python framework and other related languages Ruby, Java, Python. [3], [25]

Ariel Ortiz; Web development: In this paper Ariel Ortiz writes about the basic transition from the basic level of python skills. He used the MVC approach to projects and emphasized the reuse and integration of components with the DRY (Do Not Harvest) policy. [4], [23]

Samuel Dauzon, Arun Ravindran, Aidas Bendoraitis; Django: Web development with python learning method; This paper is about building and developing a web application from concept to model - a complete guide with all stages of web development with Django Framework. [5], [26]

Daniel Rubio - Django First - Web and Python Application Development: This basically provides tutorials on Django web application development with advanced Python based framework from basic to advanced RESTful API application development. [6], [27]

Vidal-Silva, Cristian L.; Serrano, Jorge; Sanchez-Ortiz, Aurora; Rubio, José M; Educational information on the rapid development of web application software with Python and its Django framework. This paper represents educational information for both teacher and student. [7]

Andrew Pinkham; Django Released: This book is a genre for websites, web development, web frameworks and Python but also no web application information. [8], [28].

James Bennett; Practice Django Projects: In this paper the author explained the differences between previous web development technologies and explained the best use of python and Django to build projects through different Django projects. [9] Ghimire, Devendra; Comparative research on Python-Flask and Django web frameworks: The purpose of this paper is to study the features, benefits and limit of two python-based frameworks, namely, Django and Flask. [10]

Joel Vinaka; Full stack web development using Django REStapi and React framework: In this paper the author outlines the differences between web development technology and web application development using Django. Also, it provides information for front-end and back-end frameworks to work

together. [11]

Karan Agrawal; Using machine translation to convert Python 2 into Python 3: In this paper they have tried to use dry machine translation to convert python 2 code into python 3 code. [12], [29], [30]

Eric Matthews; Python Crash Course - Program-based, project-based introduction: In this book the author talks about an anaconda and provided tutorials on the subject of a cataract crash on handmade projects. This contains all the stages from installation to a functional climate project. [13]

Julia Elman, Mark Lavin; Lightweight Django - This project is written to spread the knowledge of Django and its com- munity. This project will provide hands-on practice using projects. [14], [31]

Arun Ravindran - Django Design Patterns with Practices: In this article, the Author provided information on how to create a highly web-based Django web with all its design patterns. [15], [32]

III. Methodology

A. MVC (Model View Controller)

MVC is a software designing pattern for developing web operations. The model view control pattern consists of the following three factors.

Model- The veritably low position of pattern that's part of the MVC armature serves as a depository of data from stoner to the website. Which is responsible for managing the logical part of web operations and the way data is stored on the website.

View- This is responsible for displaying all or part of the data from the point to the stoner and maintaining the information handed by the stoner on the point. In Django View they aren't the same as they're in the introductory state of MVC.

Controller- This element at MVC, responsible for all intelligence and performance at the backend of the web operation. When a stoner raises an HTTP request, regulator receives request and returns correct response [35-37].

MVC is popular as it separates the app from the stoner interface and supports anxiety separation. Then the regulator detects all the operation requests and works with the model to configure any data demanded for viewing. View and use the data set by the regulator to produce the final silent response. The MVC summary can be represented as follows. (Fig. 1)

The Project development is done in multi-steps:
Installation of Python language in windows operating system along with addition to windows python path.
https://www.python.org/downloads/

IV. Virtual Environment installation for development of application on vscode/text editor (following command)

Fig 2 . shows the virtual env. Installation.

- pip install virtualenv wrapper-win
- mkvirtualenv environmentname (any name can be given)
- workon environment_name (Fig 3)

V. Django Installation in vscode or any other editor

- pip install Django). (Fig 4)
- create folder where you will keep your project using below cmd command
- create project by following below step:
- create app of the project in the same folder by following below commands: (Fig 5)
- Python manage.py migrate: Create Template Folder in app folder (if Template is downloaded from external source, then move that to templet folder (Fig 7)

VI. Run Server using following command:

Flow Chart (Figure 11) shows the available steps required To incorporate project requirements as well then there are steps involved in project development. The instructions in parentheses will be used in command Hurry up. They are the necessary steps to install virtual environment and the use of a local server in a system project to develop. It developers call to use any of the code text editor for Backend and frontend (VScode is used for this project development). Fig (7-9)

All changes made to the project will be available on local server and can be accessed so and the data also stored on Django's SQLite service.[38-40]

B. Project's Feasibility

Feasibility researches are used to determine the effective-ness of the idea, analogous as to guarantee that the design is licit and technically feasible and economically feasible.

C. Project Requirements

The succeeding objects were advanced in this program in order to successfully develop the design.

- User Registration
- User login
- Admin login
- Product categories
- Distinct account for each user
- User can buy products, read news and blogs
- Admin can add, update and delete resources if required
- Product page

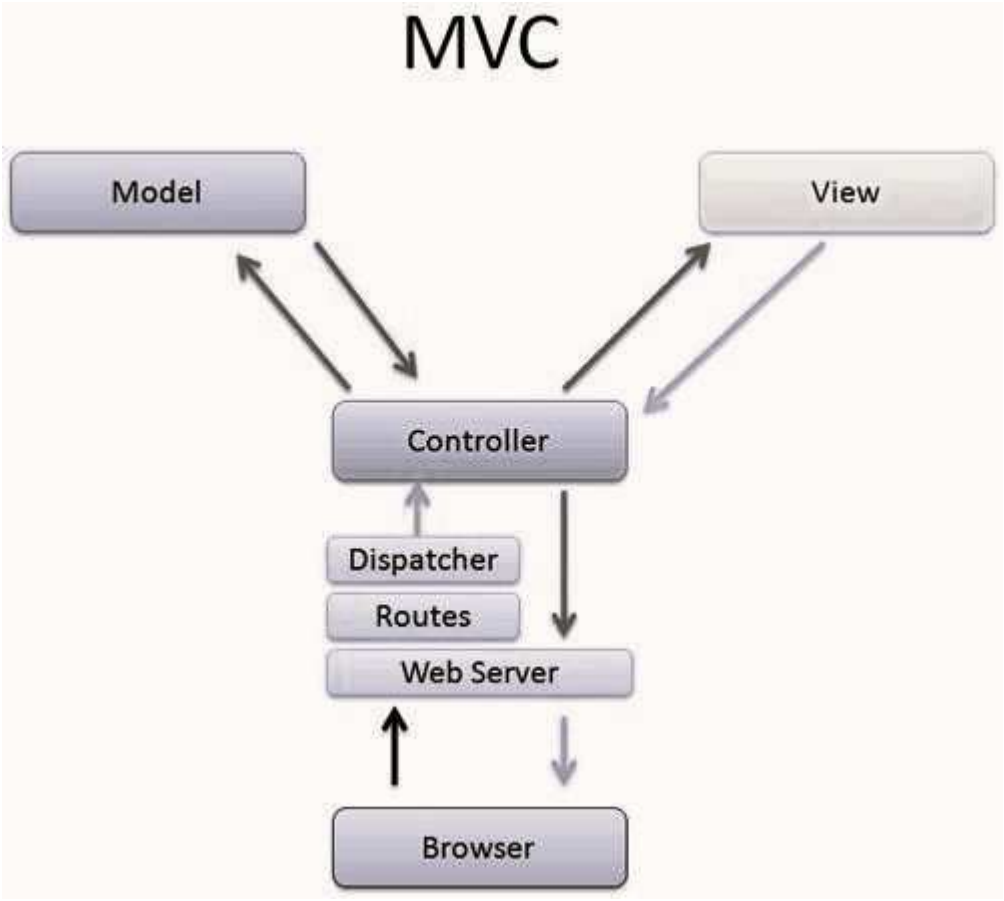

Fig. 1. MVC structure

```
PROBLEMS   OUTPUT   TERMINAL   DEBUG CONSOLE

Microsoft Windows [Version 10.0.22000.556]
(c) Microsoft Corporation. All rights reserved.

C:\Users\thema>pip install virtualenv
```

Fig. 2. Virtual env installation

```
C:\Users\thema>workon
venv

C:\Users\thema>mkvirtualenv env
created virtual environment CPython3.9.6.final.0-64 in 3408ms
  creator CPython3Windows(dest=C:\Users\thema\Envs\env, clear=False, no_vcs_ignore=False, global=False)
  seeder FromAppData(download=False, pip=bundle, setuptools=bundle, wheel=bundle, via=copy, app_data_dir=C:\Users\thema\AppData\Local\pypa\virtualenv)
    added seed packages: pip==21.3.1, setuptools==60.5.0, wheel==0.37.1
  activators BashActivator,BatchActivator,FishActivator,NushellActivator,PowerShellActivator,PythonActivator

(env) C:\Users\thema>workon env
(env) C:\Users\thema>
```

Fig. 3. mkvirtualenv and workon

```
(env) C:\Users\thema>pip install django
Collecting django
  Downloading Django-4.0.3-py3-none-any.whl (8.0 MB)
     |████████████████████████████████| 8.0 MB 133 kB/s
Collecting asgiref<4,>=3.4.1
  Using cached asgiref-3.5.0-py3-none-any.whl (22 kB)
Collecting tzdata
  Downloading tzdata-2022.1-py2.py3-none-any.whl (339 kB)
     |████████████████████████████████| 339 kB 269 kB/s
Collecting sqlparse>=0.2.2
  Using cached sqlparse-0.4.2-py3-none-any.whl (42 kB)
Installing collected packages: tzdata, sqlparse, asgiref, django
Successfully installed asgiref-3.5.0 django-4.0.3 sqlparse-0.4.2 tzdata-2022.1
```

Fig. 4. pip install Django command in vscode

```
(env) C:\Users\thema>django-admin startproject ecom

(env) C:\Users\thema>cd ecom
```

Fig. 5. start project

```
C:\Users\thema\ecom>python manage.py startapp myapp

C:\Users\thema\ecom>python manage.py makemigrations
No changes detected
```

Fig. 6. python manage.py startapp app_name

```
(env) C:\Users\thema\ecom>python manage.py migrate
Operations to perform:
  Apply all migrations: admin, auth, contenttypes, sessions
Running migrations:
  Applying contenttypes.0001_initial... OK
  Applying auth.0001_initial... OK
  Applying admin.0001_initial... OK
  Applying admin.0002_logentry_remove_auto_add... OK
  Applying admin.0003_logentry_add_action_flag_choices... OK
  Applying contenttypes.0002_remove_content_type_name... OK
  Applying auth.0002_alter_permission_name_max_length... OK
  Applying auth.0003_alter_user_email_max_length... OK
  Applying auth.0004_alter_user_username_opts... OK
  Applying auth.0005_alter_user_last_login_null... OK
  Applying auth.0006_require_contenttypes_0002... OK
  Applying auth.0007_alter_validators_add_error_messages... OK
  Applying auth.0008_alter_user_username_max_length... OK
  Applying auth.0009_alter_user_last_name_max_length... OK
  Applying auth.0010_alter_group_name_max_length... OK
  Applying auth.0011_update_proxy_permissions... OK
  Applying auth.0012_alter_user_first_name_max_length... OK
  Applying sessions.0001_initial... OK

(env) C:\Users\thema\ecom>
```

Fig. 7. Migrations

```
(env) C:\Users\thema\ecom>python manage.py runserver
Watching for file changes with StatReloader
Performing system checks...

System check identified no issues (0 silenced).
April 03, 2022 - 22:43:43
Django version 4.0.3, using settings 'ecom.settings'
Starting development server at http://127.0.0.1:8000/
Quit the server with CTRL-BREAK.
[03/Apr/2022 22:43:45] "GET / HTTP/1.1" 200 10697
[03/Apr/2022 22:43:45] "GET /static/admin/css/fonts.css HTTP/1.1" 200 423
[03/Apr/2022 22:43:46] "GET /static/admin/fonts/Roboto-Bold-webfont.woff HTTP/1.1" 200 86184
[03/Apr/2022 22:43:46] "GET /static/admin/fonts/Roboto-Light-webfont.woff HTTP/1.1" 200 85692
[03/Apr/2022 22:43:46] "GET /static/admin/fonts/Roboto-Regular-webfont.woff HTTP/1.1" 200 85876
Not Found: /favicon.ico
[03/Apr/2022 22:43:46] "GET /favicon.ico HTTP/1.1" 404 2108
```

Fig. 8. Run server

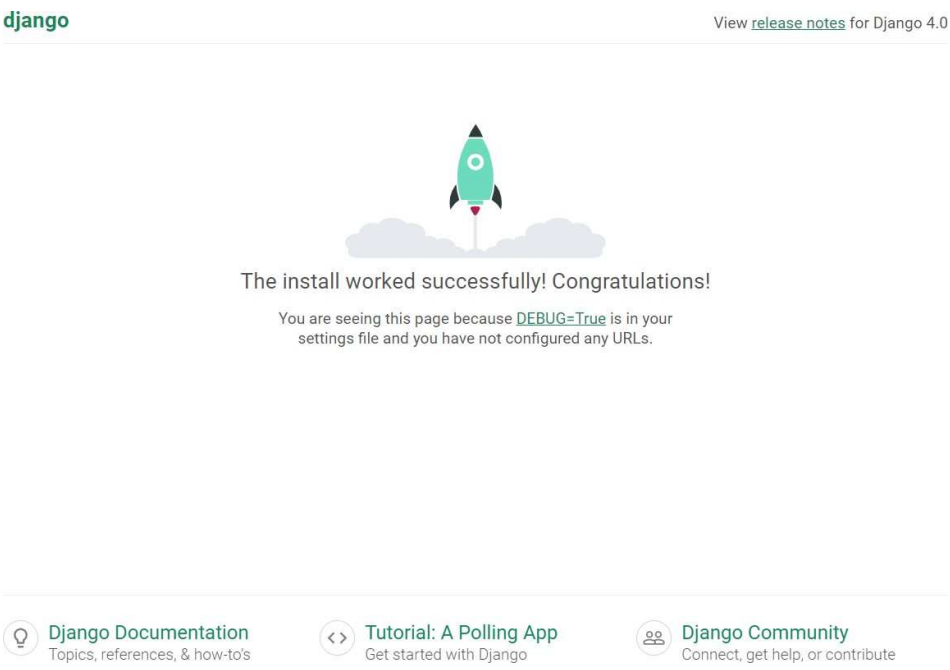

Fig. 9. http://127.0.0.1:8000/server

- Product carousels
- Blog page
- News Page
- External APIs
- Contact us
- Payment gateway
- Search Area

This list of conditions was also used as design operation during development.

Specific objects for the successful perpetration of the design should be developed and proposed, which are as follows

- Delicacy: The delicacy position system will be high. Each and every operation will be performed ensuring that any information is returning accurate.
- Methodical Approach: Website functionality organized in a manner that data visibility is attractive and easy.
- Prompt retrieval of information: Purpose this system is to give rapid fixes to successfully recoup stoner information, orders, products etc.
- Trust ability: The trust ability of project will be top most due to certain reasons mentioned over. The reason for that growing system trust ability is that what it's now could be an applicable storehouse.
- No Borrowing: this project is designed keeping in mind that only distinct information will be visible to the users. This will insure the profitable utilization storehouse and compliance in the backend data storehouse terrain.

Platform design for development purposes just before start-

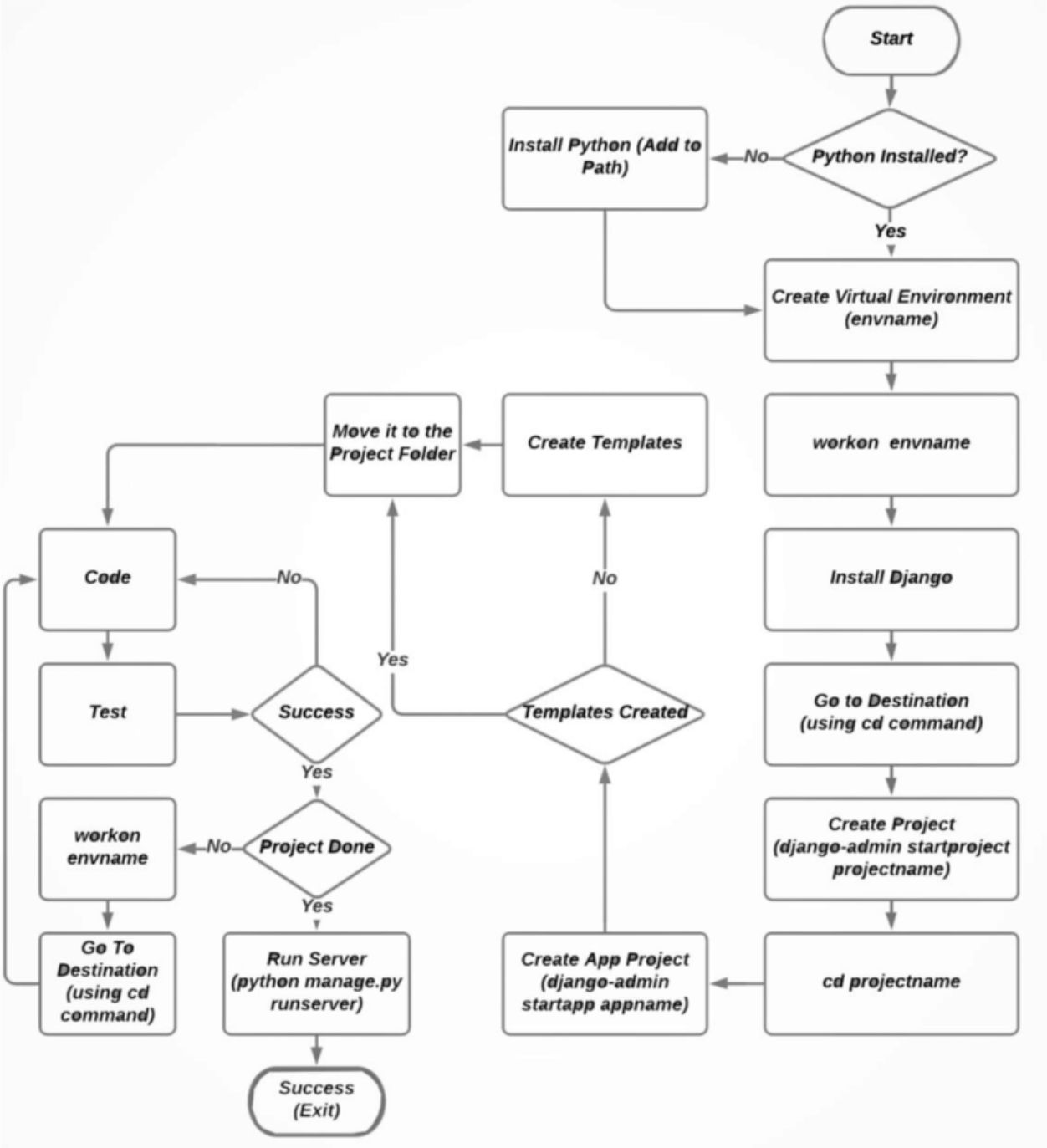

Fig. 10. Flowchart showing step required to develop project

in the law section. Since Django is best known for its "perfect for people last days "of the development phase, it's veritably easy to set up to develop a developing terrain. In addition, the Django design also builds before you start rendering as part of the field setup. Area stored data.

VII. Implementation

Technologies Used

a. Front End Technologies

i. HTML: Hyper Text Markup Language is a marking primers language developed to be displayed in a web cyber surfed. It can be enhanced with technologies similar as CSS (Cascading Style Spreadsheets) and writing languages similar as JavaScript. Originally, HTML was created solely for the purpose of defining primer structure similar as titles, orders, lists, etc. to grease the sharing of scientific knowledge among experimenters and to make it a better option. Nowadays, Hyper Text Markup Language is extensively used in development of web pages using multihued tags available in HTML language.

ii. CSS: Cascading Style Spreadsheets, as the denotation itself refers to the style sheet language especially used to describe a graphical present of primer written in mark language similar as HTML. CSS is a World Wide Web predicated technology, compatible with HTML and JavaScript.

iii. JS: JavaScript, generally shortened as JS, is the world's most cast about-after programming language which is one of the elementary technologies needed for World Web operations, near HTML and CSS. Further than 97 of online websites use JavaScript on the customer/ stoner side for web page actions, which generally involves third- party libraries.

JavaScript enables interactive web pages to come a built-in part of web operations. Large web cyber surfs have JScript machine devoted to functionality. JavaScript supports event, functionality and precedence. It's important to use JS to corroborate the form submitted by the stoner as it may contain incorrect values. Thus, verification is needed to authenticate the stoner with database.

b. Back End Technologies

i. Python: Python is a veritably complex programming language, with a common purpose. Its design ideology emphasizes reading the law and the use of critical retreats. Its language- grounded approach and object- acquainted approach end to help programmers write canons easily and logically.

ii. Django: Django is a free Python- grounded web frame with open source following architecture pattern model-template design developed and maintained by the Django Software Foundation.

iii. SQLite: SQLite is an information machine written in language C. It isn't a standalone operation; rather, it's a library of software inventors bedded in their operating systems. Therefore, it belongs to the bedded data family.

VIII. CONCLUSION

A simple designing and developing method which is cost and time effective has a great importance in this era. After analyzing the results attained, the performing design can be considered satisfactory. In conclusion, as a website it'll be veritably helpful for the users who wants do shop and want to gain every single information about particular category using blog and news sections of the site. It is providing all the needed in college or school life. In conclusion, the design development done using applicable SDLC engineering process, according to Repeated SDLC Model. Project Management created later after specialized feasibility work. By using python and Django, web development becomes very easy to implement, time and effort efficient.

REFERENCES

[1]. Garg, Deepak, Shalli Rani, Norbert Herencsar, Sahil Verma, Marcin Wozniak, and Muhammad Fazal Ijaz. 2022. "Hybrid Technique for Cyber-Physical Security in Cloud-Based Smart Industries" Sensors 22, no. 12: 4630. https://doi.org/10.3390/s22124630

[2]. Pradhan, Nihar Ranjan, Akhilendra Pratap Singh, Sahil Verma, Kavita, Navneet Kaur, Diptendu Sinha Roy, Jana Shafi, Marcin Wozniak, and Muhammad Fazal Ijaz. 2022. "A Novel Blockchain-Based Healthcare System Design and Performance Benchmarking on a Multi-Hosted Testbed" Sensors 22, no. 9: 3449. https://doi.org/10.3390/s22093449

[3]. Dogra, V.; Singh, A.; Verma, S.; Kavita; Jhanjhi, N.Z.; Talib, M.N. Analyzing DistilBERT for Sentiment Classification of Banking Financial News. Lect. Notes Netw. Syst. 2021, 248, 501–510.

[4]. Pradhan, N.R.; Singh, A.P.; Verma, S.; Wozniak, M.; Shafi, J.; Ijaz, M.F. A blockchain based lightweight peer-to-peer energy trading framework for secured high throughput micro-transactions. Sci. Rep. 2022, 12, 1–15

[5]. S. Ramisetty, D. Anand, S. Kavita, S. Verma, N. Z. Jhanjhi, and M. Humayun, "Energy-efficient model for recovery from multiple cluster nodes failure using moth flame optimization in wireless sensor networks," Intelligent Computing and Innovation on Data Science, Springer, Singapore, pp. 491–499, 2021.

[6]. Nigel George [6; Publication date: 21 December 2019, ISBN-100994616899 ISBN-13978-0994616890] - Build a Website with Django 3: A complete introduction to Django 3.

[7]. Josh Juneau, Frank Wierzbicki, Jim Baker, Alex Ng, Leo Soto Muoz, Victor Ng, Donna L. Baker [7; Publication year: 2010, ISBN-13 (pbk)-978-1-4302-2527-0 ISBN-13 (electronic)-978-1-4302-2528-7] - The Definitive Guide to Jython: Python for the Java Platform.

[8]. Jhanjhi, N. Z., Brohi, S. N., Malik, N. A., & Humayun, M. (2020, October). Proposing a hybrid rpl protocol for rank and wormhole attack mitigation using machine learning. In *2020 2nd International Conference on Computer and Information Sciences (ICCIS)* (pp. 1-6). IEEE.

[9]. K. Hussain, S. J. Hussain, N. Jhanjhi and M. Humayun, "SYN Flood Attack Detection based on Bayes Estimator (SFADBE) For MANET," *2019 International Conference on Computer and Information Sciences (ICCIS)*, Sakaka, Saudi Arabia, 2019, pp. 1-4, doi: 10.1109/ICCISci.2019.8716416.

[10]. Shah, I. A., Jhanjhi, N. Z., Amsaad, F., & Razaque, A. (2022). The Role of Cutting-Edge Technologies in Industry 4.0. In *Cyber Security Applications for Industry 4.0* (pp. 97-109). Chapman and Hall/CRC.

[11]. Zed Shaw [Publisher: Addison-Wesley, Publication date: 10 October 2013] - Hard Way to learn Python: A Very Simple Introduction to Beautiful World of Computers and Code
[12]. Fabrizio Romano, Arun Ravindran, Gaston C. Hillar [Publisher: Packt Publishing Limited, Publication date: 21 December 2018] - Learn Development with Python.
[13]. Arun Ravindran, Aidas Bendoraitis, Samuel Dauzon [Publisher: Ingram short title, Publication date: 1 January 2017] - Django: Web Development with Python.
[14]. Ben Shaw, Andrew Bird, Saurabh Badhwar, Bharath Chandra K S, Saurabh Badhwar, Chris Guest [Publisher: Packt Publishing Limited, Publication date: 25 February 2021] - Web Development with Django.
[15]. Nigel George [Publisher: Packt Publishing Ltd; Publication date: 23-Dec-2016] - Mastering Django: Core
[16]. Mark Summerfield [Publisher: Pearson Addison-Wesley Professional; Publication date: 12 November 2009] - Programming in Python 3.
[17]. Antonio Mele [Publisher: Ingram short title; Publication date: 1 January 2018] - Django 2 by Example: Build powerful web applications from scratch.
[18]. Antonio Melé [Publisher: Packt Publishing; Publication date: 31 March 2020] - Django 3 By Example: Build powerful and reliable applications from scratch, 3rd Edition.
[19]. James Bannett [Published in: 2009; Publisher: Apress Inc.] – Practical Django Projects.
[20]. Ghimire, Devendra [Publisher: Metropolia University; Published on: 5 May 2020] – Comparative study on python frameworks: Django & Flask.
[21]. Dash, Sonali et al. "A Hybrid Method to Enhance Thick and Thin Vessels for Blood Vessel Segmentation." *Diagnostics (Basel, Switzerland)* vol. 11,11 2017. 30 Oct. 2021, doi:10.3390/diagnostics11112017
[22]. Dogra, V., Singh, A. et al. "Analyzing DistilBERT for Sentiment Classification of Banking Financial News." In: Peng, SL., Hsieh, SY., Gopalakrishnan, S., Duraisamy, B. (eds) Intelligent Computing and Innovation on Data Science. Lecture Notes in Networks and Systems, vol 248. Springer, Singapore.
[23]. Kaur, M., Singh, A. et al. "FANET: Efficient Routing in Flying Ad Hoc Networks (FANETs) Using Firefly Algorithm." In: Peng, SL., Hsieh, SY., Gopalakrishnan, S., Duraisamy, B. (eds) Intelligent Computing and Innovation on Data Science. Lecture Notes in Networks and Systems, vol 248. Springer, Singapore.
[24]. Srinivasan, K., Garg, L., Datta, D., Alaboudi, A. A., Jhanjhi, N. Z., Agarwal, R., & Thomas, A. G. (2021). Performance comparison of deep cnn models for detecting driver's distraction. *CMC-Computers, Materials & Continua*, *68*(3), 4109-4124.
[25]. Khalil, M. I., Jhanjhi, N. Z., Humayun, M., Sivanesan, S., Masud, M., & Hossain, M. S. (2021). Hybrid smart grid with sustainable energy efficient resources for smart cities. *sustainable energy technologies and assessments*, *46*, 101211.
[26]. A. Almusaylim, Z., Jhanjhi, N. Z., & Alhumam, A. (2020). Detection and mitigation of RPL rank and version number attacks in the internet of things: SRPL-RP. *Sensors*, *20*(21), 5997.
[27]. Kumar, Parteek et al. "Detection of Wormhole Attack in VANET." *National Journal of System and Information Technology* 10.1 (2017): 71.
[28]. Dogra, V. et al. "Understanding of Data Preprocessing for Dimensionality Reduction Using Feature Selection Techniques in Text Classification". In: Peng, SL., Hsieh, SY., Gopalakrishnan, S., Duraisamy, B. (eds) Intelligent Computing and Innovation on Data Science. Lecture Notes in Networks and Systems, vol 248. Springer, Singapore, 2021.
[29]. Rani, P. *et al.* "Mitigation of black hole attacks using firefly and artificial neural network", *Neural Comput & Applic* (2022).
[30]. S. Ghosh, A. Singh, *et al.*, "Svm and knn based cnn architectures for plant classification," *Computers, Materials & Continua*, vol. 71, no.3, pp. 4257–4274, 2022.
[31]. Singla R, Kaur K, *Compressed and Secure Energy Efficient Routing Protocol for WBAN,* International Journal of Computer Sciences and Engineering. 2018; 6(7), 252-258.
[32]. Gurbeer Kaur and Navneet Kaur, *Cost Effective Energy Efficient and Secure Routing Protocol (CESR) for WBAN,* International Journal of Computer Applications 169(4), 37-43, July 2017
[33]. Ashfaq, F., Jhanjhi, N. Z., & Khan, N. A. (2023, April). Badminton Player's Shot Prediction Using Deep Learning. In *Innovation and Technology in Sports: Proceedings of the International Conference on Innovation and Technology in Sports,(ICITS) 2022, Malaysia* (pp. 233-243). Singapore: Springer Nature Singapore.
[34]. Sennan, S., Somula, R., Luhach, A. K., Deverajan, G. G., Alnumay, W., Jhanjhi, N. Z., ... & Sharma, P. (2021). Energy efficient optimal parent selection based routing protocol for Internet of Things using firefly optimization algorithm. *Transactions on Emerging Telecommunications Technologies*, *32*(8), e4171.
[35]. K. Shankar, Recent Advances in Sensing Technologies for Smart Cities, International Journal of Wireless and Ad Hoc Communication, Vol. 1 , No. 1 , (2020) : 05-15 (Doi : https://doi.org/10.54216/IJWAC.010101)
[36]. A. Sariga , J. Uthayakumar, Type 2 Fuzzy Logic based Unequal Clustering algorithm for multi-hop wireless sensor networks, International Journal of Wireless and Ad Hoc Communication, Vol. 1 , No. 1 , (2020) : 33-46 (Doi : https://doi.org/10.54216/IJWAC.010102)
[37]. Irina V. Pustokhina, Blockchain technology in the international supply chains, International Journal of Wireless and Ad Hoc Communication, Vol. 1 , No. 1 , (2020) : 16-25 (Doi : https://doi.org/10.54216/IJWAC.010103)
[38]. R.Pandi Selvam, Performance of MAODV and ODMRP Routing Protocol for Group Communication in Mobile Ad Hoc Network, International Journal of Wireless and Ad Hoc Communication, Vol. 1 , No. 1 , (2020) : 26-32 (Doi : https://doi.org/10.54216/IJWAC.010104)
[39]. Aditya Sharma , Aditya Vats , Shiv Shankar Dash , Surinder Kaur, Artificial Intelligence enabled virtual sixth sense application for the disabled, Fusion: Practice and Applications, Vol. 1 , No. 1 , (2020) : 32-39 (Doi : https://doi.org/10.54216/FPA.010104)
[40]. Surinder Kaur , Shivani Mankotia , Pooja Bharadwaj, Study of Multi-Prime RSA, Fusion: Practice and Applications, Vol. 1 , No. 1 , (2020) : 40-48 (Doi : https://doi.org/10.54216/FPA.010105)