WEB PHISHING DETECTION

A PROJECT REPORT

Submitted by

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CHAPTER 1

INTRODUCTION

1.1 Project Overview:

Hook is a website which is used to detect phishing sites to improve the customer's sense of safety whenever he/she attempts to provide any sensitive information to a site. Also, by which people won't access them which will reduce the revenue of malicious site owners. This application can be accessed online without paying instead, can be accessed via any browser of the customer's choice to detect any site with high accuracy. This system uses machine learning algorithm which implements classification algorithms and techniques to extract the phishing datasets criteria to classify their legitimacy.

The design and implementation of a comprehensive web phishing detection system instils a cyber security culture which prevents the need for the deployment of targeted anti-phishing solutions in a corporate to meet industry's compliance obligations.

1.2 Purpose:

Web phishing is a threat in various aspects of security on the internet, which might involve scams and private information disclosure. Some of the common threats of web phishing are:

- Attempt to fraudulently solicit personal information from an individual or organization.
- Attempt to deliver malicious software by posing as a trustworthy organization or entity.
- Installing those malwares infects the data that cause a data breach or even nature's forces that takes down your company's data headquarters, disrupting access.

For this purpose, the objective of our project involves building an efficient and intelligent system to detect such websites by applying a machine-learning algorithm which implements classification algorithms and techniques to extract the phishing datasets criteria to classify their legitimacy and as a result of which whenever a user makes a transaction online and makes payment through an e-banking website our system will use a data mining algorithm to detect whether the e-banking website is a phishing website or not.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing problem:

There are phishing detection sites out in the web. But they charge users after a limit of usage. Most of them are built on a clean set of features. We have carefully analysed and identified several factors that could be used to detect a phishing site. These factors fall under the categories of address bar-based features, domain-based features, HTML & JavaScript based features. Using these features, we build an intelligent system which can identify a phishing site with high accuracy and efficiency. It is also an open-source website which will be easily accessible to all users.

2.2 References:

1.Yingying Xu; Guangxuan Chen; Qiang Liu; Wanpeng Xu; Lei Zhang; Jiajian Wu; Xiaoshi Fan. “A Phishing Website Detection and Recognition Method Based on Naive Bayes”,2022

2. Atharva Deshpande, Omkar Pedamkar, Nachiket Chaudhary, Dr. Swapna Borde. “Detection of Phishing Websites using Machine Learning”, Cyber Security, pp.2-25,2021

3. Ayesha Arshad , Attique Ur Rehman , Sabeen Javaid, Tahir Muhammad Ali , Javed Anjum Sheikh , Muhammad Azeem “Review on Phishing and Anti-Phishing Techniques” Information Science pp.0-14, 2021

4. Malaika Rastogi, Anmol Chhetri, Divyanshu Kumar Singh, Gokul Rajan V “Detection And Prevention On Web Phishing Using Machine Learning” Applied Data Science pp.45-47, 2021.

5. A.Jain, B.Gupta “A survey of phishing attack techniques, defence mechanisms and open research challenges”, Applied Data Science,pp.0-14,2021

6. Harinahalli Lokesh G and Bore Gowda G “Phishing website detection based on effective machine learning approach”,Journal of Cyber Security Technology,pp.1-14,2020

7. M. Vijayalakshmi , S. Mercy Shalinie, Ming Hour Yang, Raja Meenakshi U “Web phishing detection techniques: a survey on the state-of-the-art, taxonomy and future directions”,IET Networks pp.07-11,2020

8.Prachit Raut, Harshal Vengurlekar, Rishikesh Shete “A Survey of Phishing Website Detection Systems”, Applied Data Science ,2020

9. poonam kumari, apoorva h r gowda, bhandhavya k, bhavya m u, spurthi m n, 2020, detecting phishing-sites using hybrid model, international journal of engineering research & technology (ijert) ncetesft – 2020 (volume 8 – issue 14)

10. S.Carolin Jeeva, Elijah Blessing Rajsingh “Intelligent phishing URL detection using association rule mining”, Applied Data Science,pp.35-37,2016

2.3 Problem statement definition:

Web Phishing is a form of cyber fraud, which implies that fraudsters use various means to impersonate the URL address and page content of a real website or use vulnerabilities in the server program of a real website to insert dangerous HTML code in certain pages of the site.

It is a threat in various aspects of security on the internet, which might involve scams and private information disclosure. Some of the common threats of web phishing are:

- Obtaining personal information from an individual or organization.
- Impersonating as a trustworthy organization to deliver malicious websites.

To avoid these threats, we build an efficient and intelligent system to detect such websites using machine-learning algorithms which implements classification algorithms and techniques to extract the phishing datasets criteria to classify their legitimacy.

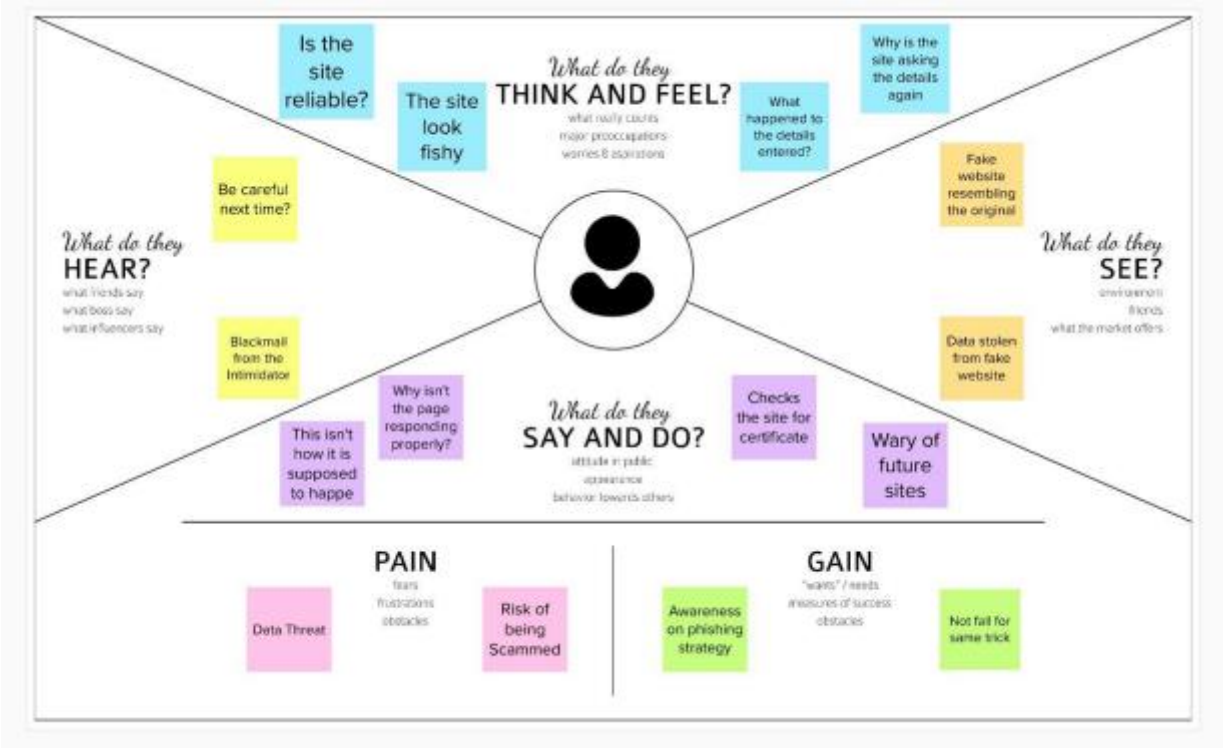
This project can also be further extended by creating a browser extension or developing a GUI which takes the URL and analyses its nature to determine if it is a legitimate or a phishing website.

CHAPTER 3

IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas:

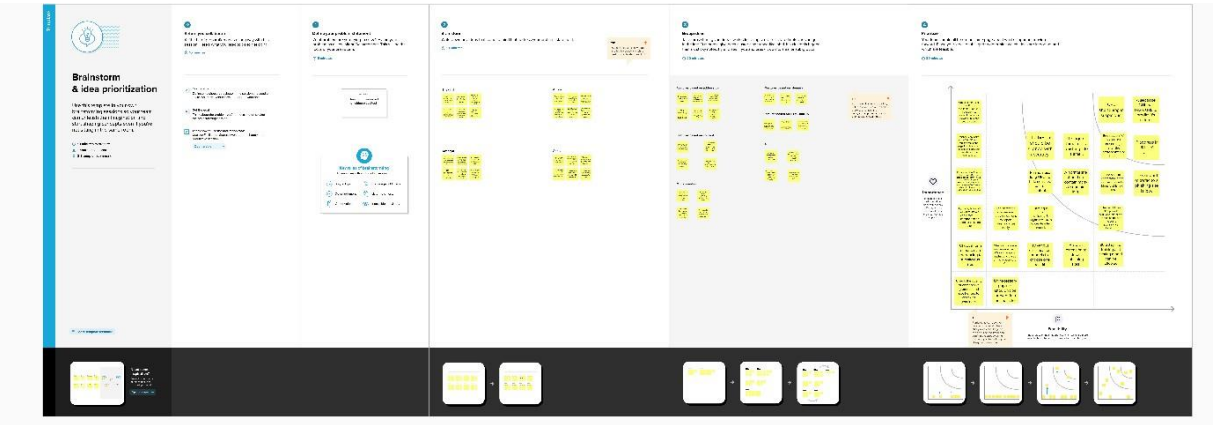
An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. Empathy maps should be used throughout any UX process to establish common ground among team members and to understand and prioritize user needs. In user-centered design, empathy maps are best used from the very beginning of the design process.



3.2 Ideation & Brainstorming:

Ideation essentially refers to the whole creative process of coming up with and communicating new ideas. Ideation is innovative thinking, typically aimed at solving a problem or providing a more efficient means of doing or accomplishing something.

Ideation is often closely related to the practice of brainstorming, a specific technique that is utilized to generate new ideas. A principal difference between ideation and brainstorming is that ideation is commonly more thought of as being an individual pursuit, while brainstorming is almost always a group activity.



3.3 **Proposed Solution:**

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Novel phishing approaches suffer low detection accuracy. The most common technique used is the blacklist-based method. It has become inefficient since registering a new domain has become easier. No comprehensive blacklist can ensure a perfect up-to-date database.
2.	Idea / Solution description	Our solution is to build an efficient and intelligent system to detect phishing sites by applying a machine learning algorithm which implements classification algorithms and techniques to extract the phishing datasets criteria to classify their legitimacy.
3.	Novelty / Uniqueness	We have carefully analysed and identified various factors that could be used to detect a phishing site. These factors fall under the categories of address bar based features, domain based features, HTML & Javascript based features. Using these features we can identify a phishing site with high accuracy.
4.	Social Impact / Customer Satisfaction	By using this application the customer has the sense of safety whenever he attempts to provide sensitive information to a site.
5.	Business Model (Revenue Model)	By generating leads we can improve our business model. By detecting the phishing sites, people won't access them which will reduce the revenue of malicious site owners.

6.	Scalability of the Solution	This application can be accessed online without paying. It can be accessed via any browser of your choice. It can detect any site with high accuracy.

3.4 Problem Solution fit

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioural patterns and recognize what would work and why.

Purpose:

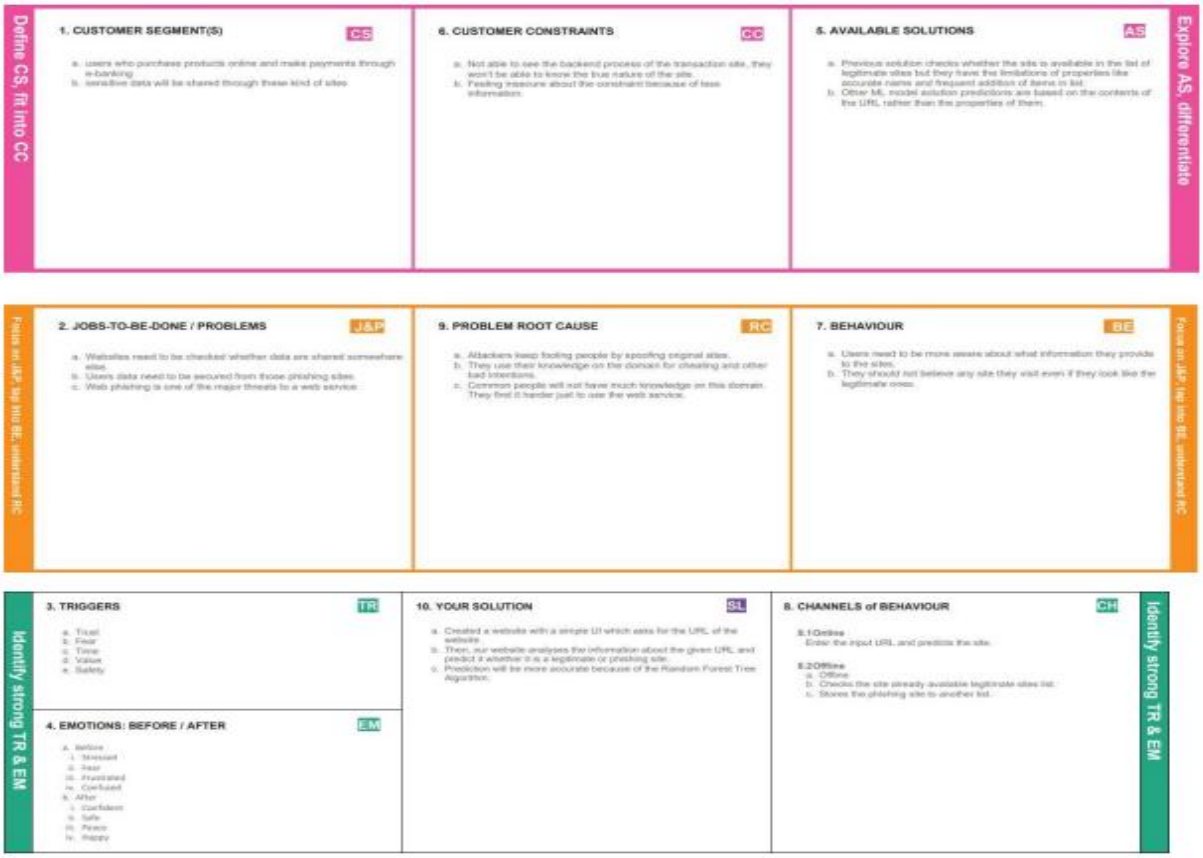
❑ Solve complex problems in a way that fits the state of your customers.

❑ Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behaviour.

❑ Sharpen your communication and marketing strategy with the right triggers and messaging.

❑ Increase touchpoints with your company by finding the right problem-behaviour fit and building trust by solving frequent annoyances, or urgent or costly problems.

❑ Understand the existing situation in order to improve it for your target group.



CHAPTER 4

REQUIREMENT ANALYSIS

4.1 Functional requirements:

FR No.	Functional Requirement (Epic)	Description
FR-1	User Input	User inputs an URL in the form to check whether it is a malicious website.
FR-2	Website comparison	The model compares the given URL with the list of phishing URLs present in the database.
FR-3	Feature Extraction	If it is found none on the comparison it extracts the HTML and domain-based features from the URL.
FR-4	Prediction	The model predicts the URL using machine Learning algorithms such as Random Forest technique.
FR-5	Classifier	Model then sends the output to the classifier and produces the result.
FR-6	Announcement	The model finally displays whether the given URL is phishing or not.

4.2 Non-functional requirements:

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It is an easy to use and access interface which results in greater efficiency.
NFR-2	Security	It is a secure website which protects the sensitive information of the user and prevents malicious attacks.
NFR-3	Reliability	The system can detect phishing websites with greater accuracy using ML algorithms.
NFR-4	Performance	The system produces responses within seconds and execution is faster.
NFR-5	Availability	Users can access the website via any browser from anywhere at any time.
NFR-6	Scalability	This application can be accessed online without paying. It can detect any web site with high accuracy.

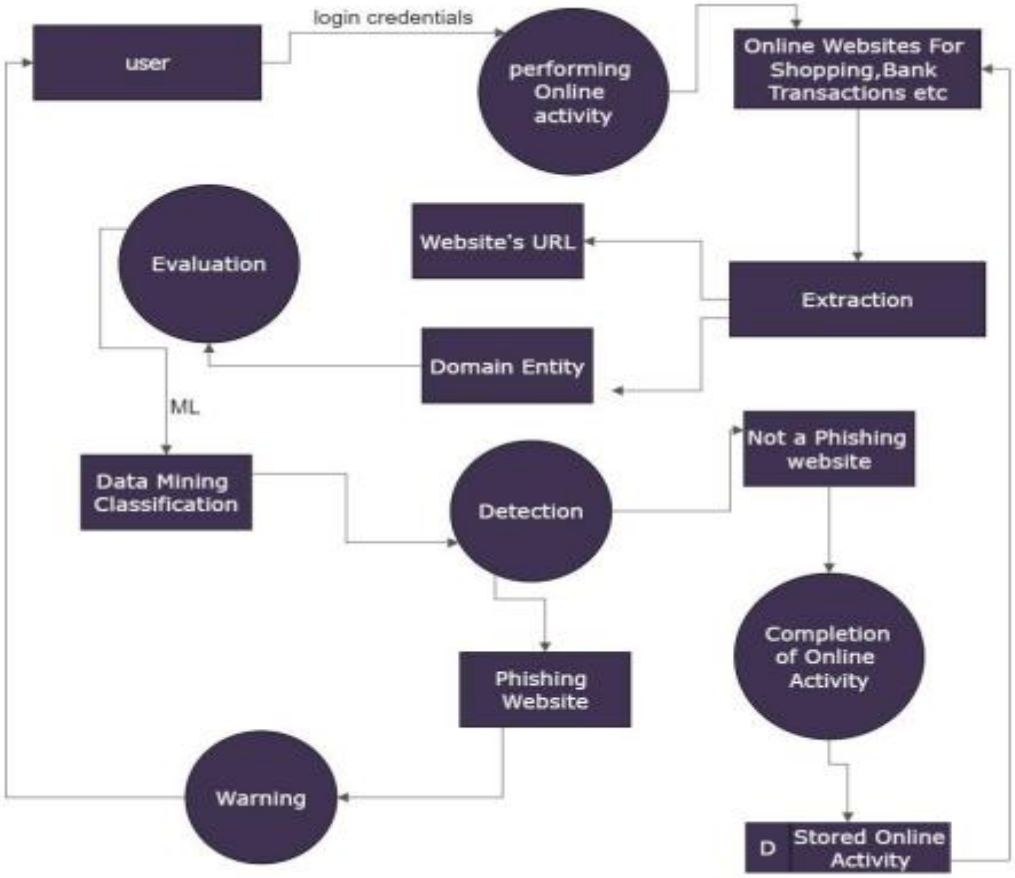
CHAPTER 5

PROJECT DESIGN

5.1 Data Flow diagram:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

DFD level 0:



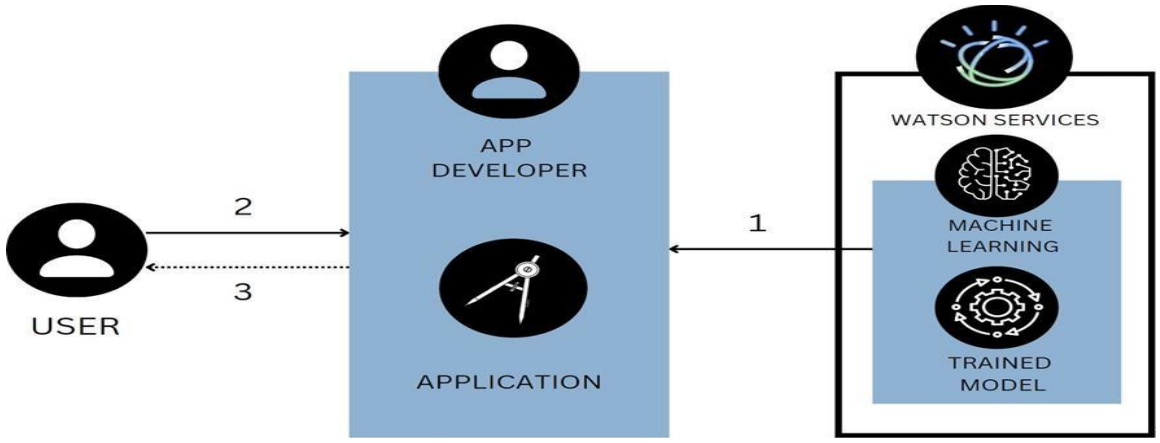
5.2 Solution & Technical Architecture:

SOLUTION:

Our solution is to build an efficient and intelligent system to detect phishing sites by applying a machine learning algorithm which implements classification algorithms and techniques to extract the phishing datasets criteria to classify their legitimacy by carefully analysing and identifying various factors that could be used to detect a phishing site. These factors fall under the categories of address bar-based features, domain-based features, HTML & JavaScript based features. Using these features, we can identify a phishing site with high accuracy.

TECHNICAL ARCHITECTURE:

Technical architecture which is also often referred to as application architecture includes the major components of the system, their relationships, and the contracts that define the interactions between the components. The goal of technical architects is to achieve all the business needs with an application that is optimized for both performance and security.

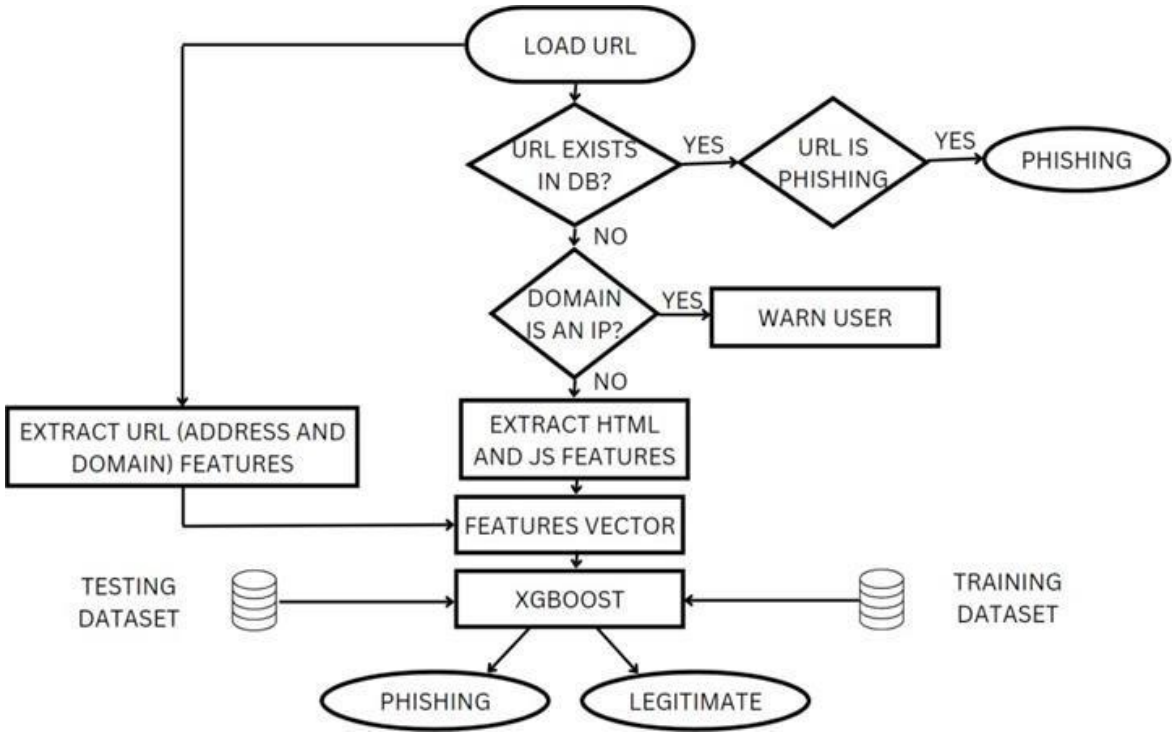


1. The application developer builds a Python-based app and deploys it.

2. The user enters the URL of a website in the application to check for its genuineness.

3. The user submits the URL through the web-based application and gets back the result.

4. The user makes a decision whether to proceed surfing in that website or move to another one.



5.3 User Stories:

User type	**Functional requirement (Epic)**	**User Story number**	**User story/task**	**Acceptance criteria**
Customer (web user)	Login	USN-1	As a user, I can navigate into the website.	I can access the page.
	Dashboard	USN-2	As a user, I will paste the URL that needs to be checked if it's a phishing website or not.	I can paste the URL in the textbox.
		USN-3	As a user, I can see the output.	I can see if it's a safe site.
Administrator		USN-4	If the new URL is found, I can add the new state into the database.	I can add the new URL.

CHAPTER 6

PROJECT PLANNING & SCHEDULING

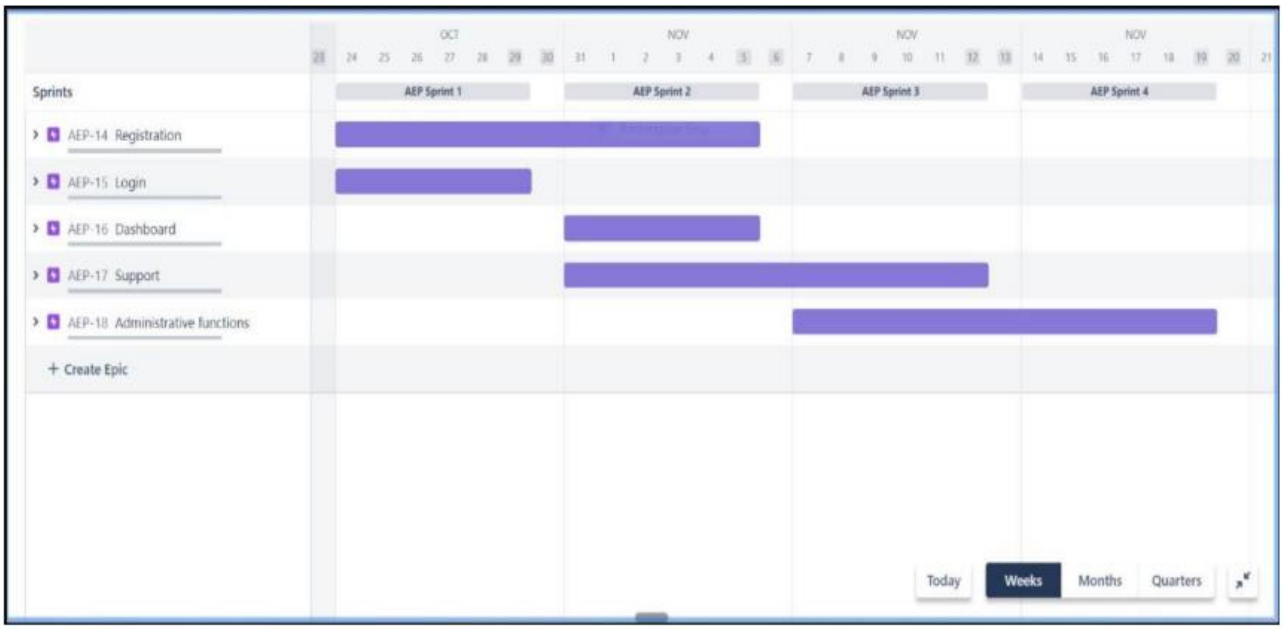
6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	Login	USN-1	As a user, I can navigate into the website.	1	High
Sprint-1	Dashboard	USN-2	As a user, Iwill input any site's URL in the form to check its genuineness.	1	High
Sprint-1		USN-3	As a user, I can see the output.	2	High
Sprint-2	Backend	USN-4	As an admin, if a new URL isfound, I can add the new state into the database.	3	Medium
Sprint-3	Report	USN-5	As a user, I can ask my queries and report suspicious sites in the report box.	1	Low
Sprint-4		USN-6	As an admin, I can take actions to the queriesasked by the user.	2	Low

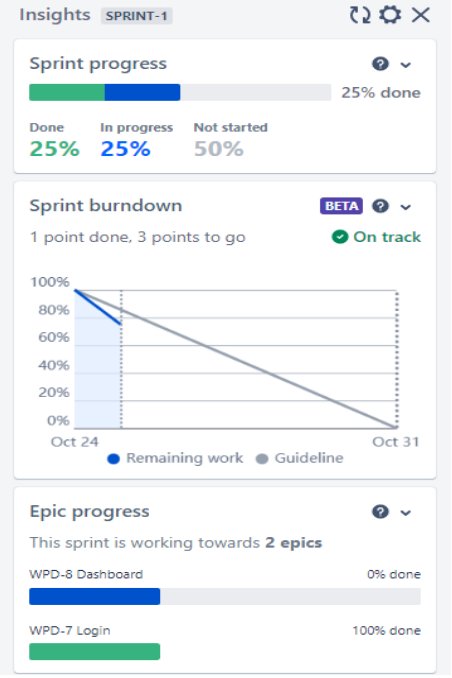
6.2 Sprint Delivery Schedule:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA:



Insights:



CHAPTER 7

CODING & SOLUTIONING

7.1 Feature 1 – Classification of URL:

The primary feature of this project is to classify the given URL as phishing or benign. Various classification algorithms are used to achieve this.

7.1.1 Methodology:

7.1.1.1 Data collection:

URL features of legitimate websites and phishing websites were collected. The data set consists of total 11,055 URLs which include 6,157 legitimate URLs and 4,898 phishing URLs. Legitimate URLs are labelled as “1” and phishing URLs are labelled as “-1”. The features that are present in the data set include:

- IP Address in URL
- Length of URL
- Using URL Shortening Services
- "@" Symbol in URL
- Redirection "//" in URL
- Prefix or Suffix "-" in Domain
- Having Sub Domain
- Length of Domain Registration
- Favicon
- Port Number
- HTTPS Token
- Request URL

- URL of Anchor
- Links in Tags
- SFH
- Email Submission
- Abnormal URL
- Status Bar Customization (on mouse over)
- Disabling Right Click
- Presence of Popup Window
- IFrame Redirection
- Age of Domain
- DNS Record
- Web Traffic
- Page Rank
- Google Index
- Links pointing to the page
- Statistical Report
- Result

Using IBM Cloud Storage this data is accessed throughout the project. The code written below is used to import the dataset.

```
import os, types

import pandas as pd

from botocore.client import Config

import ibm_boto3

def __iter__(self): return 0

# The following code accesses a file in your IBM Cloud Object
Storage. It includes your credentials.

# You might want to remove those credentials before you share the
notebook.

cos_client = ibm_boto3.client(service_name='s3',

    ibm_api_key_id='',

    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",

    config=Config(signature_version='oauth'),

    endpoint_url='https://s3.private.us.cloud-object-
storage.appdomain.cloud')


bucket = 'webphishingdetection-donotdelete-pr-icmjtvktnzli2s'

object_key = 'dataset_website.csv'


body = cos_client.get_object(Bucket=bucket,Key=object_key)['Body']

# add missing_iter_method, so pandas accepts body as file-like
object

if not hasattr(body, "__iter__"): body.__iter__= types.MethodType(
__iter__, body )


data0 = pd.read_csv(body)

data0.head()
```

7.1.1.2 Data pre-processing and Exploratory Data Analysis:

Few plots and graphs were drawn to find how the data is distributed and the how features are related to each other.

Univariate analysis:

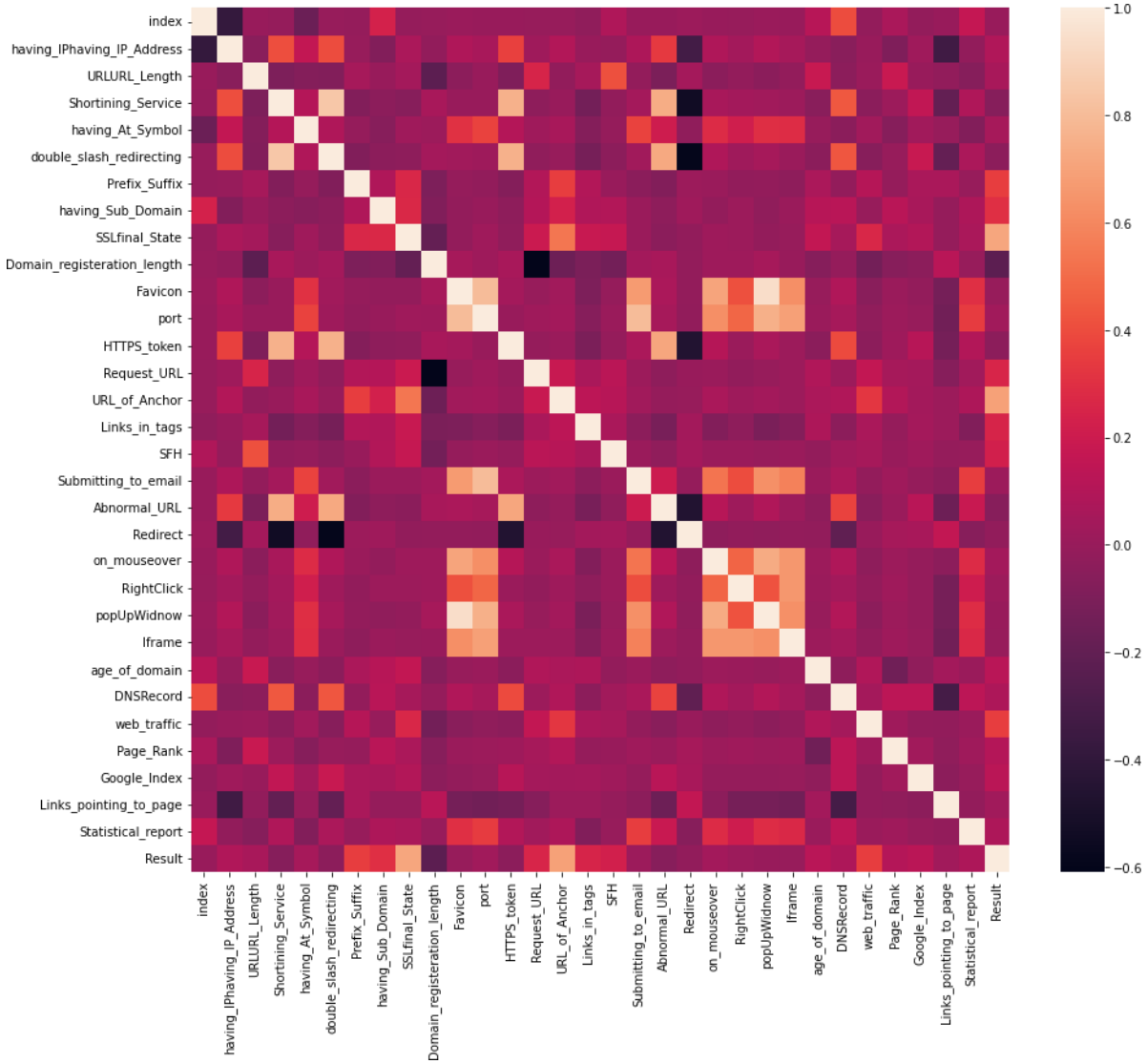
Univariate analysis provides an understanding in the characteristics of each feature in the data set. Different characteristics are computed for numerical and categorical data. For the numerical features characteristics are standard deviation, skewness, kurtosis, percentile, interquartile range (IQR) and range. For the categorical features characteristics are count, cardinality, list of unique values, top and freq.

```
data0.describe()
```

	index	having_IPhaving_IP_Address	URLURL_Length	Shortining_Service	having_At_Symbol	double_slash_redirecting	Prefix_Suffix	having_Sub_Domain	SSLfinal_State	Domain_registeration_length	...	popUpWidnow	Iframe	age_of_domain	DNSRecord	web_traffic	Page_Rank	Google_I
count	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	...	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.000000	11055.00
mean	5528.000000	0.313795	0.633198	0.738761	0.700588	0.741474	0.734962	0.063953	0.250927	-0.336771	...	0.611188	0.816915	0.061719	0.377114	0.287291	-0.483673	0.72
std	3191.447847	0.949534	0.766095	0.673998	0.713598	0.671011	0.678139	0.815518	0.911892	0.941629	...	0.789818	0.576784	0.998168	0.926209	0.827733	0.875289	0.69
min	1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	...	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.000000	-1.00
25%	2764.500000	-1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	-1.000000	-1.000000	-1.000000	...	1.000000	1.000000	-1.000000	-1.000000	0.000000	-1.000000	1.00
50%	5528.000000	1.000000	-1.000000	1.000000	1.000000	1.000000	-1.000000	0.000000	1.000000	1.000000	...	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.00
75%	8291.500000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	...	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.00
max	11055.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	...	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.00

Bivariate analysis:

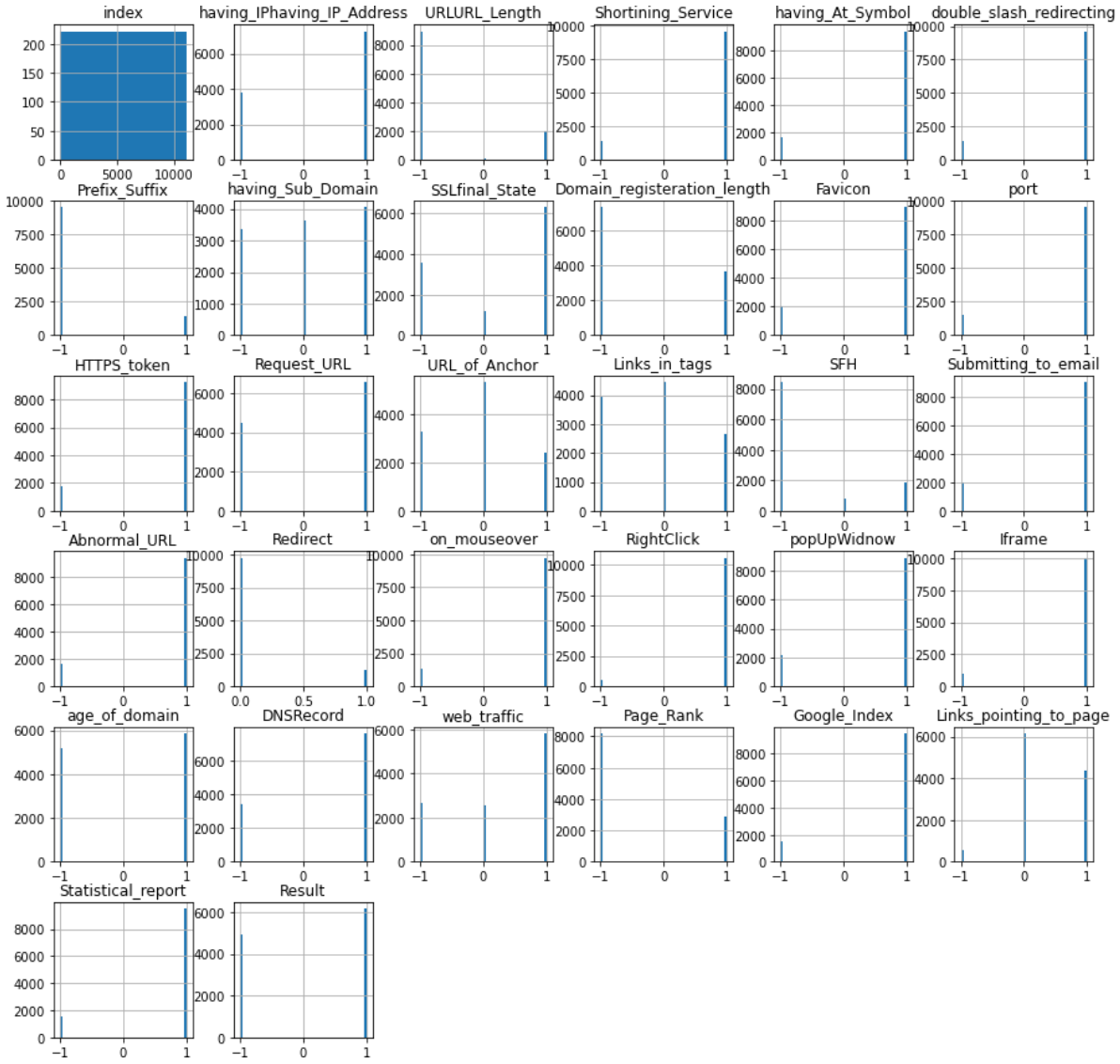
```
plt.figure(figsize=(15,13))
sns.heatmap(data0.corr())
plt.show()
```



From this correlation matrix, it is evident that there is no correlation with many features. So, it is crucial to eliminate these features.

Multivariate analysis:

```
data0.hist(bins = 50,figsize = (15,15))
plt.show()
```



From data distribution graph and correlation matrix, we can conclude that the following features do not have much impact on the result:

- having_Sub_Domain
- Domain_registeration_length
- Favicon
- Request_URL
- URL_of_Anchor

- Links_in_tags
- Submitting_to_email
- Redirect
- web_traffic
- Page_Rank
- Google_Index
- Links_pointing_to_page

All the above features will not be included in further processing.

```
#Removing the features which do not have much impact on Result
data=data0.iloc[:,[1,2,3,4,5,6,12,20,21,22,23,24,25,30,31]]
data.head()
```

Checking for null values:

This dataset doesn't contain any null values.

```
#checking the data for null or missing values
data.isnull().sum()
```

```
having_IPhaving_IP_Address    0
URLURL_Length                 0
Shortining_Service            0
having_At_Symbol              0
double_slash_redirecting      0
Prefix_Suffix                 0
HTTPS_token                   0
on_mouseover                  0
RightClick                    0
popUpWidnow                   0
Iframe                        0
age_of_domain                 0
DNSRecord                     0
Statistical_report            0
Result                        0
dtype: int64
```

7.1.1.3 Model building:

From the dataset above, it is clear that this is a supervised machine learning task. There are two major types of supervised machine learning problems, called classification and regression.

This data set comes under classification problem, as the input URL is classified as phishing (-1) or legitimate (1). The supervised machine learning models (classification) considered to train the dataset in this notebook are:

- XGBoost
- Decision Tree
- Random Forest
- Support Vector Machines

XGBoost:

XGBoost is one of the most popular machine learning algorithms these days. XGBoost stands for eXtreme Gradient Boosting. Regardless of the type of prediction task at hand; regression or classification. XGBoost is an implementation of gradient boosted decision trees designed for speed and performance.

```
#XGBoost Classification model
from xgboost import XGBClassifier


import warnings
warnings.filterwarnings("ignore", category=UserWarning)


# instantiate the model
xgb = XGBClassifier(learning_rate=0.4,max_depth=7,verbosity = 0)
#fit the model
xgb.fit(X_train, y_train)
#predicting the target value from the model for the samples
y_test_xgb = xgb.predict(X_test)
y_train_xgb = xgb.predict(X_train)
#computing the accuracy of the model performance
acc_train_xgb = accuracy_score(y_train,y_train_xgb)
acc_test_xgb = accuracy_score(y_test,y_test_xgb)


print("XGBoost: Accuracy on training Data:
{:.3f}".format(acc_train_xgb))
print("XGBoost : Accuracy on test Data: {:.3f}".format(acc_test_xgb))
```

Decision Tree Classifier:

Decision trees are widely used models for classification and regression tasks. Essentially, they learn a hierarchy of if/else questions, leading to a decision. Learning a decision tree means learning the sequence of if/else questions that gets us to the true answer most quickly.

In the machine learning setting, these questions are called tests (not to be confused with the test set, which is the data we use to test to see how generalizable our model is). To build a tree, the algorithm searches over all possible tests and finds the one that is most informative about the target variable.

```
# Decision Tree model
from sklearn.tree import DecisionTreeClassifier


# instantiate the model
tree = DecisionTreeClassifier(max_depth = 5)
# fit the model
tree.fit(X_train, y_train)
#predicting the target value from the model for the samples
y_test_tree = tree.predict(X_test)
y_train_tree = tree.predict(X_train)
#computing the accuracy of the model performance
acc_train_tree = accuracy_score(y_train,y_train_tree)
acc_test_tree = accuracy_score(y_test,y_test_tree)


print("Decision Tree: Accuracy on training Data:
{:.3f}".format(acc_train_tree))
print("Decision Tree: Accuracy on test Data:
{:.3f}".format(acc_test_tree))
```

Random Forest Classifier:

Random forests for regression and classification are currently among the most widely used machine learning methods. A random forest is essentially a collection of decision trees, where each tree is slightly different from the others. The idea behind random forests is that each tree might do a relatively good job of predicting, but will likely overfit on part of the data.

If we build many trees, all of which work well and overfit in different ways, we can reduce the amount of overfitting by averaging their results. To build a random forest model, you need to decide on the number of trees to build (the n_estimators parameter of RandomForestRegressor or RandomForestClassifier). They are very powerful, often work well without heavy tuning of the parameters, and don’t require scaling of the data.

```
# Random Forest model
from sklearn.ensemble import RandomForestClassifier
# instantiate the model
forest = RandomForestClassifier(max_depth=5)
# fit the model
forest.fit(X_train, y_train)
#predicting the target value from the model for the samples
y_test_forest = forest.predict(X_test)
y_train_forest = forest.predict(X_train)
#computing the accuracy of the model performance
acc_train_forest = accuracy_score(y_train,y_train_forest)
acc_test_forest = accuracy_score(y_test,y_test_forest)


print("Random forest: Accuracy on training Data:
{:.3f}".format(acc_train_forest))
print("Random forest: Accuracy on test Data:
{:.3f}".format(acc_test_forest))
```

Support Vector Machines:

In machine learning, support-vector machines (SVMs, also support-vector networks) are supervised learning models with associated learning algorithms that analyse data used for classification and regression analysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier.

```
#Support vector machine model
from sklearn.svm import SVC
# instantiate the model
svm = SVC(kernel='linear', C=1.0, random_state=12)
#fit the model
svm.fit(X_train, y_train)
#predicting the target value from the model for the samples
y_test_svm = svm.predict(X_test)
y_train_svm = svm.predict(X_train)
```

```
#computing the accuracy of the model performance
acc_train_svm = accuracy_score(y_train,y_train_svm)
acc_test_svm = accuracy_score(y_test,y_test_svm)

print("SVM: Accuracy on training Data: {:.3f}".format(acc_train_svm))
print("SVM : Accuracy on test Data: {:.3f}".format(acc_test_svm))
```

7.1.2 User interface:

The user opens the site and inputs a URL to check its legitimacy. Necessary features are extracted from this URL and predictions are made.

7.1.2.1 Feature extraction:

We will extract the 13 features that we used to train our model.

IP Address in URL:

Checks for the presence of IP address in the URL. URLs may have IP address instead of domain name. If an IP address is used as an alternative of the domain name in the URL, we can be sure that someone is trying to steal personal information with this URL.

If the domain part of URL has IP address, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def having_IPhaving_IP_Address(self):
        try:
            ipaddress.ip_address(self.url)
            return -1
        except:
            return 1
```

Length of URL:

Computes the length of the URL. Phishers can use long URL to hide the doubtful part in the address bar. In this project, if the length of the URL is greater than or equal 54 characters then the URL classified as phishing otherwise legitimate.

If the length of URL >= 54, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def URLURL_Length(self):
    if len(self.url) < 54:
      return 1
    else:
      return -1
```

Using URL Shortening Services:

URL shortening is a method on the “World Wide Web” in which a URL may be made considerably smaller in length and still lead to the required webpage. This is accomplished by means of an “HTTP Redirect” on a domain name that is short, which links to the webpage that has a long URL.

If the URL is using Shortening Services, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def Shortining_Service(self):
      shortening_services =
r"bit\.ly|goo\.gl|shorte\.st|go2l\.ink|x\.co|ow\.ly|t\.co|tinyurl|tr\.im|is\.gd|cli\.gs|" \
r"yfrog\.com|migre\.me|ff\.im|tiny\.cc|url4\.eu|twit\.ac|su\.pr|twurl\.nl|snipurl\.com|" \
r"short\.to|BudURL\.com|ping\.fm|post\.ly|Just\.as|bkite\.com|snipr\.com|fic\.kr|loopt\.
us|" \
r"doiop\.com|short\.ie|kl\.am|wp\.me|rubyurl\.com|om\.ly|to\.ly|bit\.do|t\.co|lnkd\.in|
db\.tt|" \
r"qr\.ae|adf\.ly|goo\.gl|bitly\.com|cur\.lv|tinyurl\.com|ow\.ly|bit\.ly|ity\.im|q\.gs|is\.gd|
" \
r"po\.st|bc\.vc|twitthis\.com|u\.to|j\.mp|buzurl\.com|cutt\.us|u\.bb|yourls\.org|x\.co|"
\
r"prettylinkpro\.com|scrnch\.me|filoops\.info|vzturl\.com|qr\.net|1url\.com|tweez\.me|v
\.gd|" \
                  r"tr\.im|link\.zip\.net"
      match=re.search(shortening_services,self.url)
      if match:
         return -1
      else:
         return 1
```

"@" Symbol in URL:

Checks for the presence of '@' symbol in the URL. Using “@” symbol in the URL leads the browser to ignore everything preceding the “@” symbol and the real address often follows the “@” symbol.

If the URL has '@' symbol, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def having_At_Symbol(self):
      if "@" in self.url:
         return -1
      else:
return 1
```

Redirection "//" in URL:

Checks the presence of "//" in the URL. The existence of “//” within the URL path means that the user will be redirected to another website. The location of the “//” in URL is computed. We find that

if the URL starts with “HTTP”, that means the “//” should appear in the sixth position. However, if the URL employs “HTTPS” then the “//” should appear in seventh position.

If the "//" is anywhere in the URL apart from after the protocol, thee value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def double_slash_redirecting(self):
    pos = self.url.rfind('//')
    if pos > 6:
        if pos > 7:
            return -1
        else:
            return 1
    else:
        return 1
```

Prefix or Suffix "-" in Domain:

Checking the presence of '-' in the domain part of URL. The dash symbol is rarely used in legitimate URLs. Phishers tend to add prefixes or suffixes separated by (-) to the domain name so that users feel that they are dealing with a legitimate webpage.

If the URL has '-' symbol in the domain part of the URL, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def Prefix_Suffix(self):
    if '-' in urlparse(self.url).netloc:
        return -1
    else:
        return 1
```

HTTPS Token:

Checks for the presence of "http/https" in the domain part of the URL. The phishers may add the “HTTPS” token to the domain part of a URL in order to trick users.

If the URL has "http/https" in the domain part, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def HTTPS_token(self):
    domain = urlparse(self.url).netloc
    if 'https' in domain:
        return -1
    else:
        return 1
```

Status Bar Customization (on mouse over):

Phishers may use JavaScript to show a fake URL in the status bar to users. To extract this feature, we must dig-out the webpage source code, particularly the “onMouseOver” event, and check if it makes any changes on the status bar.

If the response is empty or onmouseover is found then, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def on_mouseover(self):
    try:
      if re.findall("", self.response.text):
        return -1
      else:
        return 1
    except:
      return -1
```

Disabling Right Click:

Phishers use JavaScript to disable the right-click function, so that users cannot view and save the webpage source code. This feature is treated exactly as “Using onMouseOver to hide the Link”. Nonetheless, for this feature, we will search for event “event.button==2” in the webpage source code and check if the right click is disabled.

If the response is empty or onmouseover is not found then, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def RightClick(self):
    if self.response == "":
      return -1
    else:
      if re.findall(r"event.button ?== ?2", self.response.text):
        return 1
      else:
        return -1
```

Presence of Popup Window:

Pop up windows are another option used by phishers to redirect users to other pages. They display attractive ads to lure the user to click the link. Nonetheless, for this feature, we will search for event “alert” in the webpage source code and check if it is present.

If the response is empty or alert is not found then, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def popUpWidnow(self):
    try:
      if re.findall(r"alert\(", self.response.text):
        return 1
      else:
        return -1
    except:
      return -1
```

IFrame Redirection:

IFrame is an HTML tag used to display an additional webpage into one that is currently shown. Phishers can make use of the “iframe” tag and make it invisible i.e. without frame borders. In this regard, phishers make use of the “frameBorder” attribute which causes the browser to render a visual delineation.

If the iframe is empty or repsonse is not found then, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
def Iframe(self):
    try:
      if re.findall(r"[<iframe>|<frameBorder>]", self.response.text):
        return 1
      else:
        return -1
    except:
      return -1
```

Age of Domain:

This feature can be extracted from WHOIS database. Most phishing websites live for a short period of time. The minimum age of the legitimate domain is considered to be 12 months for this project. Age here is nothing but different between creation and expiration time.

If age of domain > 12 months, the vlaue of this feature is -1 (phishing) else 1 (legitimate).

```
def age_of_domain(self):
    creation_date = self.domain_name.creation_date
    expiration_date = self.domain_name.expiration_date
    if (isinstance(creation_date,str) or isinstance(expiration_date,str)):
      try:
        creation_date = datetime.strptime(creation_date,'%Y-%m-%d')
        expiration_date = datetime.strptime(expiration_date,"%Y-%m-%d")
      except:
        return -1
    if ((expiration_date is None) or (creation_date is None)):
      return -1
    elif ((type(expiration_date) is list) or (type(creation_date) is list)):
```

```
    return -1
  else:
    ageofdomain = abs((expiration_date - creation_date).days)
    if ((ageofdomain/30) < 6):
      return -1
    else:
      return 1
```

DNS Record:

For phishing websites, either the claimed identity is not recognized by the WHOIS database or no records founded for the hostname.
If the DNS record is empty or not found then, the value assigned to this feature is -1 (phishing) or else 1 (legitimate).

```
dns = -1
try:
  self.domain_name = whois.whois(urlparse(url).netloc)
except:
  dns = 1
```

7.1.2.2 Dashboard:

The home page of our site “Hook” contains all basic features of the site and a form to get input(URL) from the user.

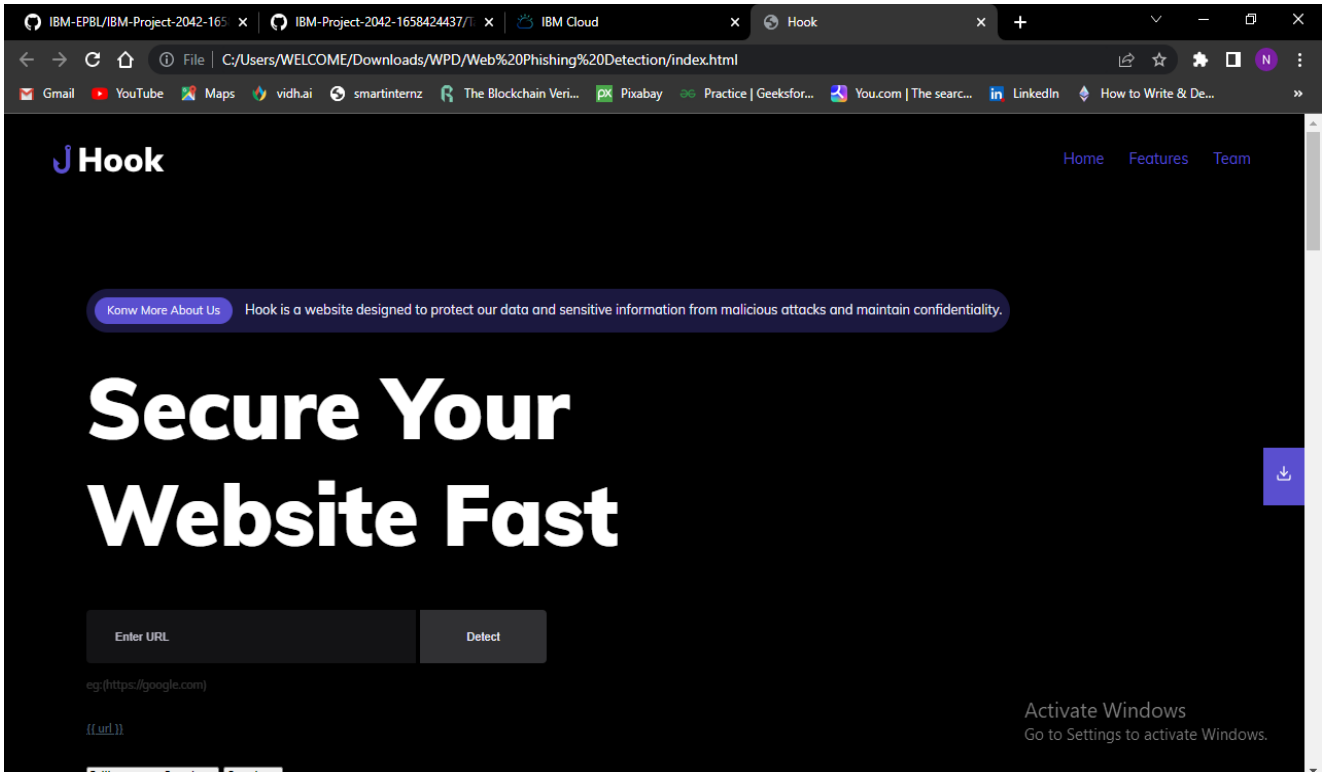


Fig 7.1 Home page

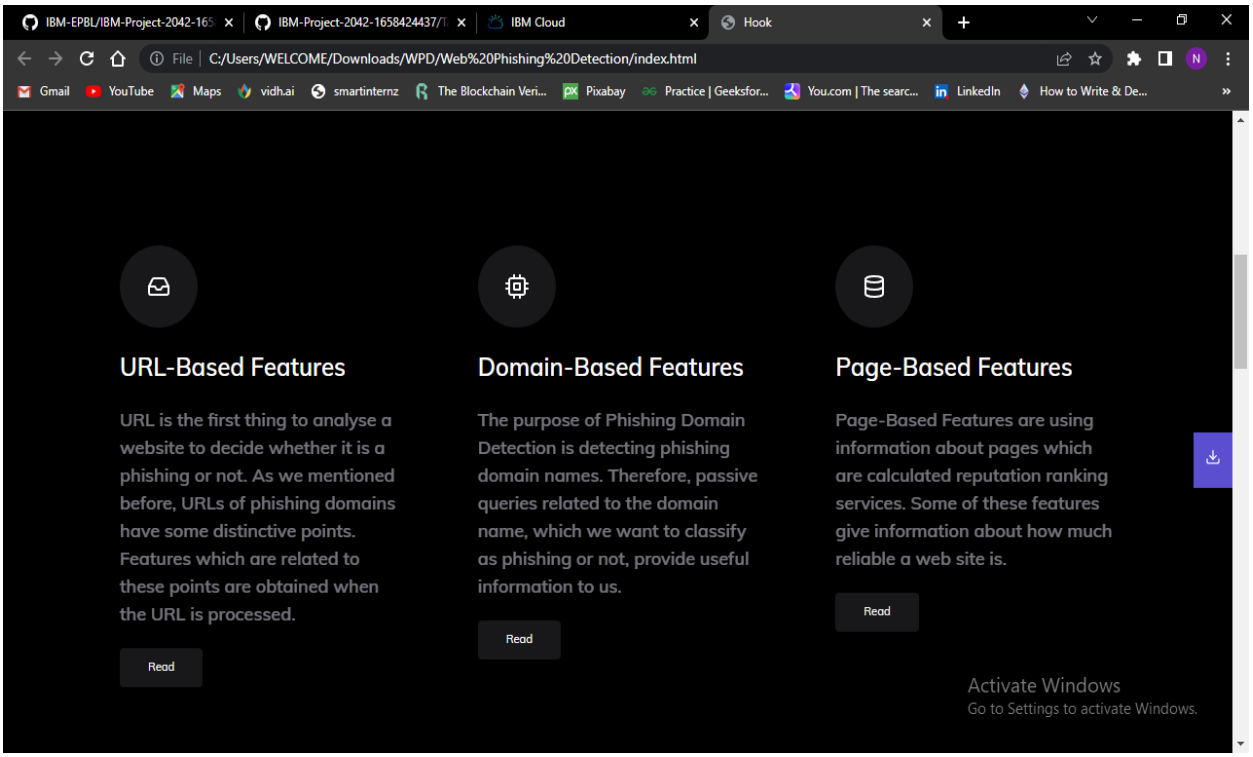


Fig 7.2 Services section

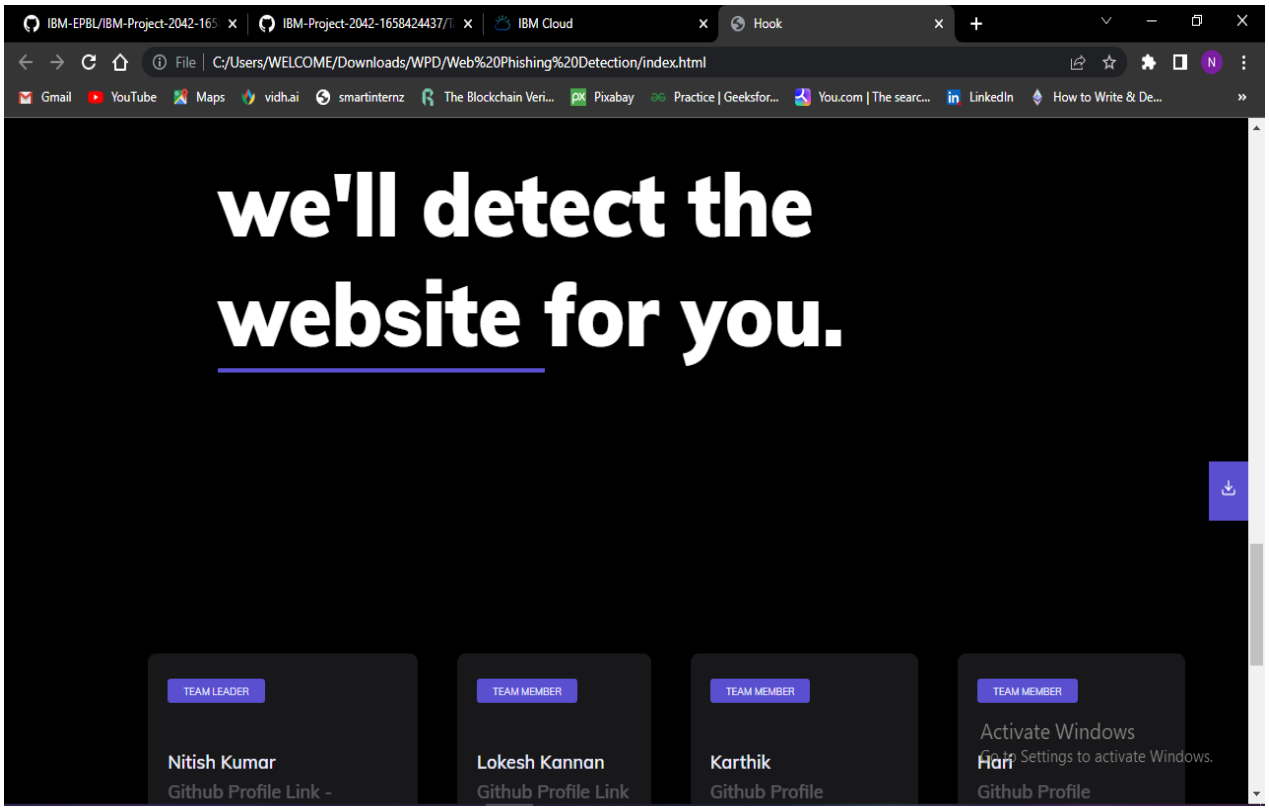


Fig 7.3 Teams section

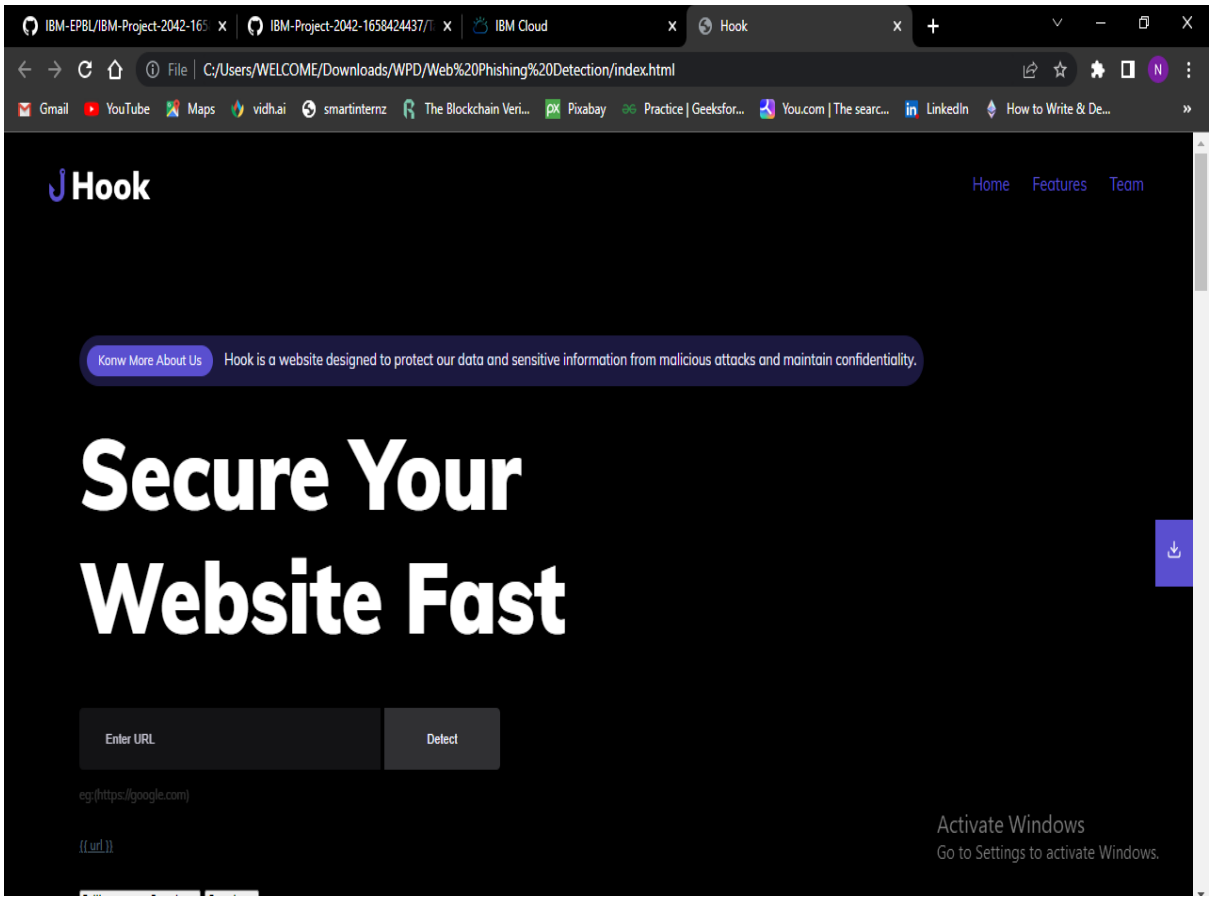


Fig 7.4 Legitimate URL input from user

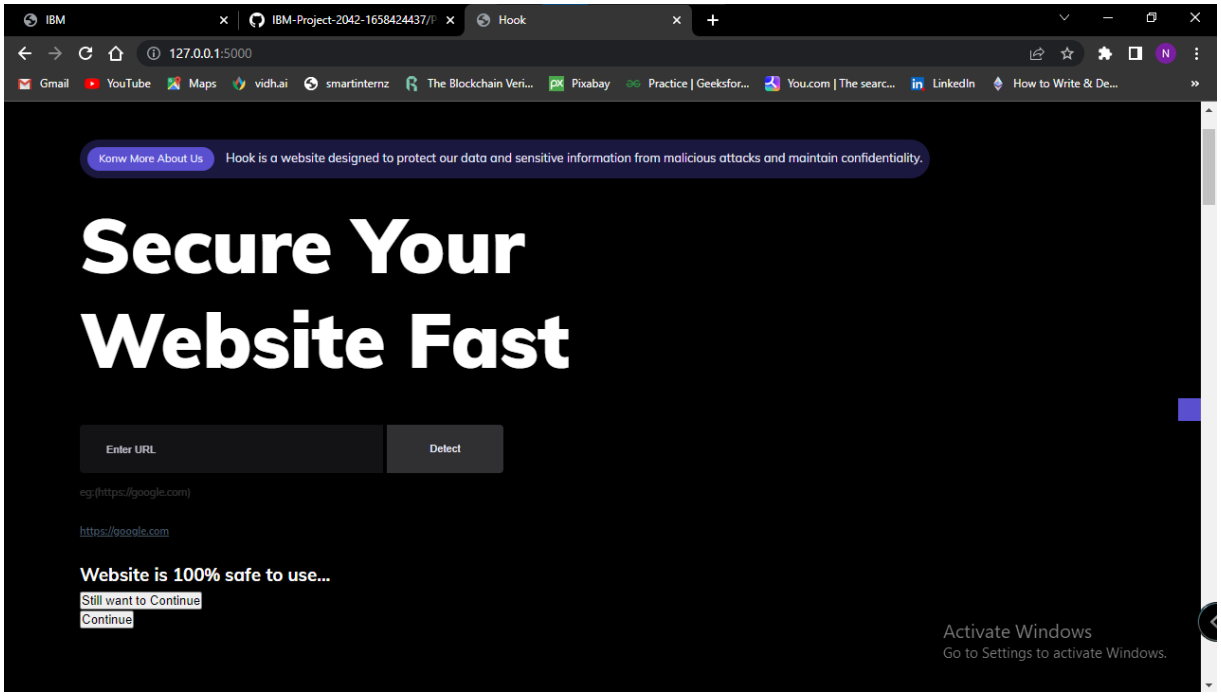


Fig 7.5 Legitimate URL result displayed to the user

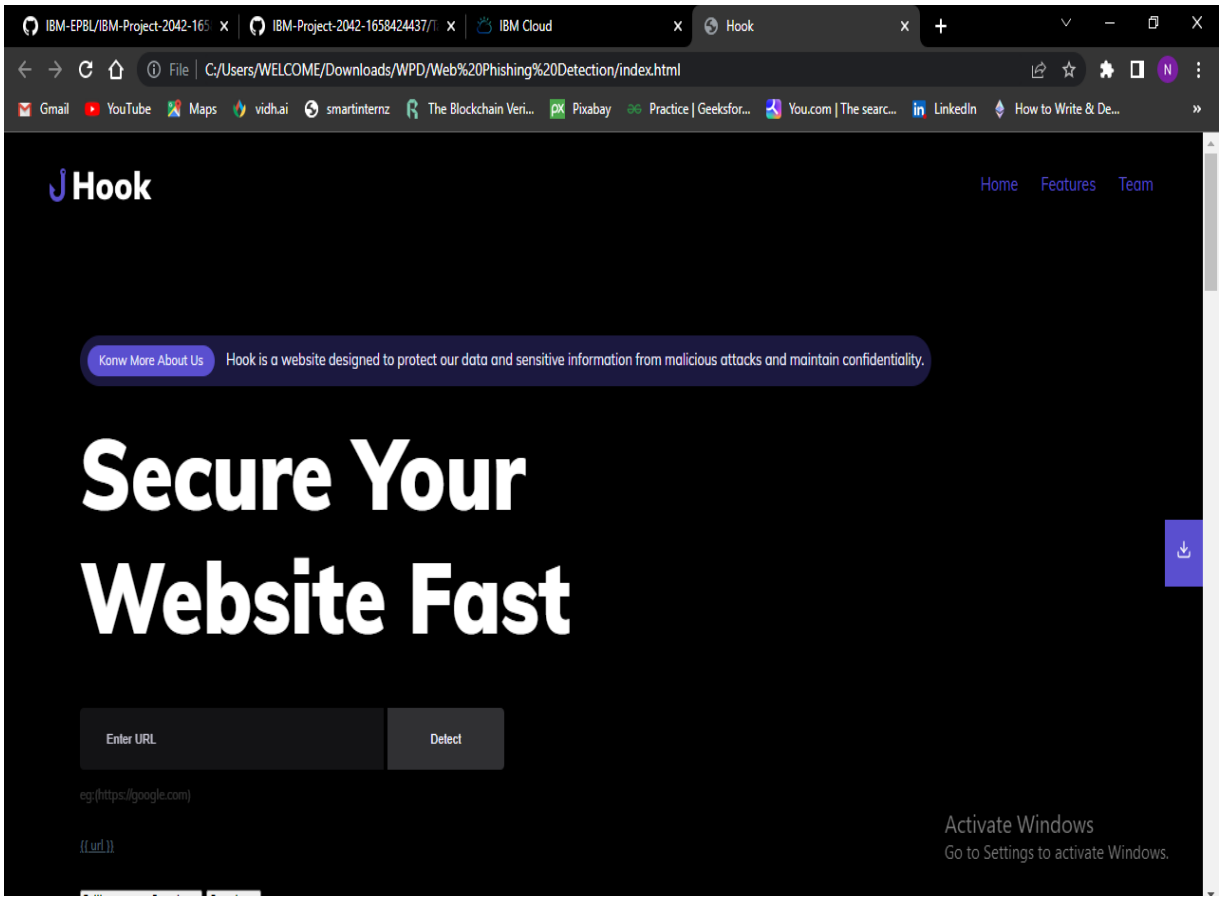


Fig 7.6 Phishing URL input from user

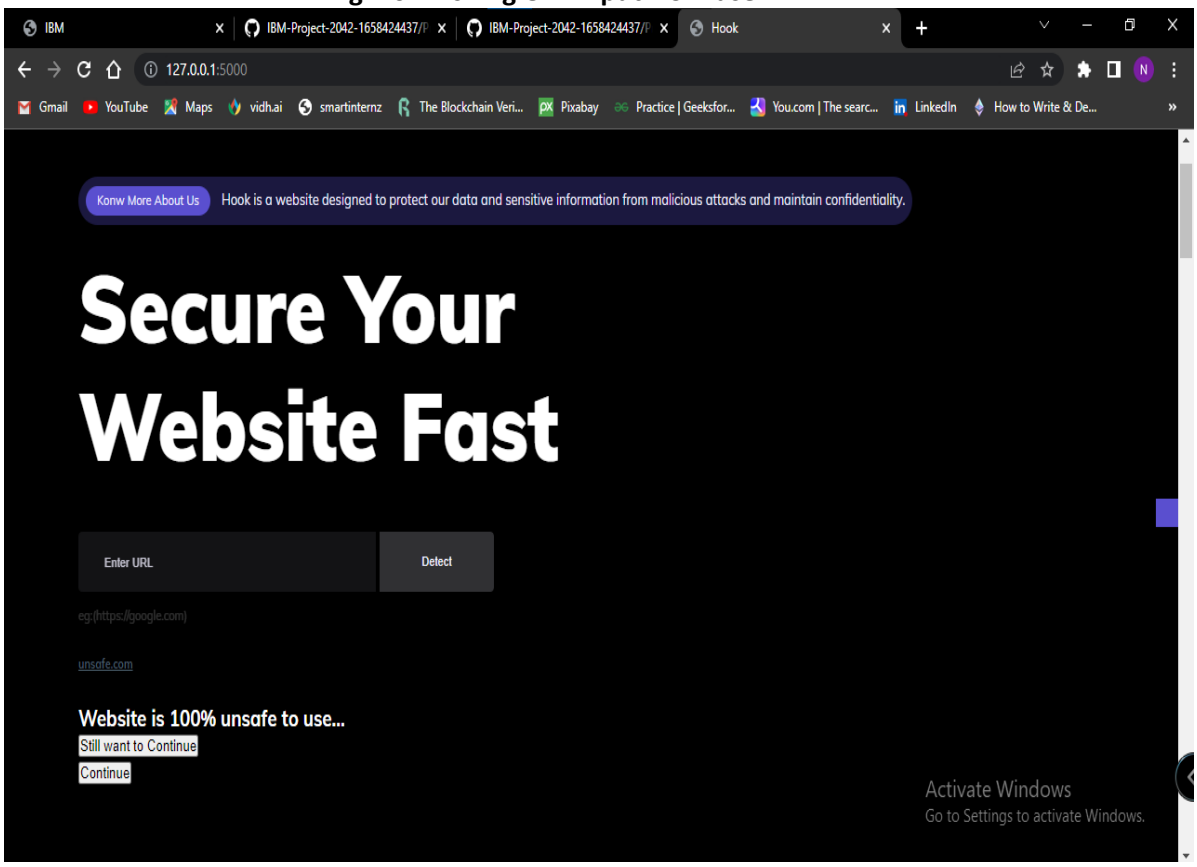


Fig 7.7 Phishing URL result displayed to the user

CHAPTER 8

TESTING

8.1 Test Cases:

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status
DashBoard_TC_OO1	Functional	Home Page	Verify user is able to enter the URL in the form	1. Open Hookwebsite 2. Enter a URL and click submit	https://google.com/	Result of classification will be displayed	Working as expected	Pass
DashBoard_TC_OO2	UI	Home Page	Verify the UI elements in the form	1. Enter URL and click go 2. The services and teams' sections are visible 3. Enter a URL and click submit	https://google.com/	Application should show below UI elements: a. input form b. submit button c. services d. team	Working as expected	Pass
DashBoard_TC_OO3	Functional	Home page	Verify user is able to see an alert when nothing is entered in the textbox	1. Enter URL and click go 2. Enter nothing and click submit 3. An alert is displayed to provide proper input		Alert of incomplete input	Working as expected	Pass
DashBoard_TC_OO4	Functional	Home page	Verify user is able to see the result when URL is entered in the textbox	1. Enter URL and click go 2. Enter any URL and click submit 3. The result of the classification is displayed.	https://google.com/	Result of classification will be displayed	Working as expected	Pass

8.2 User Acceptance Testing:

Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

Test Case Analysis:

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5-
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

CHAPTER 9

RESULTS

9.1 Performance metrics:

The median efficiency is used to assess each categorization model's effectiveness. The final item will appear in the way it was envisioned. Graphical representations are used to depict information during classification. The percentage of predictions made using the testing dataset is used to gauge accuracy. By dividing the entire number of forecasts even by properly predicted estimates, it is simple to calculate. The difference between actual and anticipated output is used to calculate accuracy.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN}$$

Where TP = True Positives, TN = True Negatives, FN = False Negatives and FP = False Positives.

Thus, accuracy for all the four used models were calculated and ranked. XGBoost performed better than other models.

	ML Model	Train Accuracy	Test Accuracy
3	XGBoost	0.913	0.905
0	Decision Tree	0.898	0.894
1	Random Forest	0.893	0.886
2	SVM	0.886	0.883

Fig 9.1 Performance metrics

CHAPTER 10

ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- **Increases user alertness to phishing risks** Whenever the user navigates into the website and provide the URL of the website that needs to be verified for legitimacy, the system detects phishing sites by applying a machine learning algorithm which implements classification algorithms and techniques to extract the phishing datasets criteria to classify their legitimacy which in turn helps the customers to eliminate the risks of cyber threat and protect their valuable corporate or personal data.

- **Users will also be able to pose any query to the admin through the report page designed** Our system is also provided with an option for the clients to report to the administrator which helps them to ask their questions significantly improving their experience on our site.

DISADVANTAGES:

- Not a generalized model
- Huge number of rules
- Needs feed continuously

CHAPTER 11

CONCLUSION

Phishing detection is now an area of great interest among the researchers due to its significance in protecting privacy and providing security. There are many methods to perform phishing detection. Our system aims to enhance the detection method to detect phishing websites using machine learning technology. We achieved a high detection accuracy, and the results show that the classifiers give better performance when we use more data as training data.

In future, hybrid technology will be implemented to detect phishing websites more accurately.

CHAPTER-12

FUTURE SCOPE

In future we intend to build an add-ons for our system and if we get a structured dataset of phishing, we can perform phishing detection much faster than any other technique. We can also use a combination of any two or more classifiers to get maximum accuracy. We plan to explore various phishing techniques which use Network based features, Content based features, Webpage based features and HTML and JavaScript features of web pages which will improve the performance of the system. In particular, we extract features from URLs and pass it through the various classifiers.

CHAPTER 13

APPENDIX

13.1 Source code:

app.py

```
#importing required libraries

from flask import Flask, request, render_template
import numpy as np
import pandas as pd
from sklearn import metrics
import warnings
import pickle
warnings.filterwarnings('ignore')
from feature import FeatureExtraction
import colorama
from colorama import Fore

file = open("urlmodel.pkl", "rb")
gbc = pickle.load(file)
file.close()


app = Flask(__name__)

@app.route("/", methods=["GET", "POST"])
def index():
    if request.method == "POST":

        url = request.form["url"]
        obj = FeatureExtraction(url)
        x = np.array(obj.getFeaturesList()).reshape(1,30)

        y_pred =gbc.predict(x)[0]
```

```
        #1 is safe
        #-1 is unsafe
        y_pro_phishing = gbc.predict_proba(x)[0,0]
        y_pro_non_phishing = gbc.predict_proba(x)[0,1]
        # if(y_pred ==1 ):
        pred = "It is {0:.2f} % safe to go ".format(y_pro_phishing*100)
        return render_template('index.html',xx
=round(y_pro_non_phishing,2),url=url )
    return render_template("index.html", xx =-1)
if __name__ == "__main__":
    app.run(debug=True,port=5000)
```

Feature.py

```
import ipaddress
import re
from urllib import response
import urllib.request
from bs4 import BeautifulSoup
import socket
import requests
from googlesearch import search
import whois
from datetime import date, datetime
import time
from dateutil.parser import parse as date_parse
from urllib.parse import urlparse

class FeatureExtraction:
    features = []
    def __init__(self,url):
        self.features = []
        self.url = url
        self.domain = ""
        self.whois_response = ""
        self.urlparse = ""
        self.response = ""
        self.soup = ""

        try:
            self.response = requests.get(url)
            self.soup = BeautifulSoup(response.text, 'html.parser')
        except:
            pass

        try:
            self.urlparse = urlparse(url)
            self.domain = self.urlparse.netloc
        except:
            pass

        try:
```

```
            self.whois_response = whois.whois(self.domain)
        except:
            pass



        self.features.append(self.UsingIp())
        self.features.append(self.longUrl())
        self.features.append(self.shortUrl())
        self.features.append(self.symbol())
        self.features.append(self.redirecting())
        self.features.append(self.prefixSuffix())
        self.features.append(self.SubDomains())
        self.features.append(self.Hppts())
        self.features.append(self.DomainRegLen())
        self.features.append(self.Favicon())


        self.features.append(self.NonStdPort())
        self.features.append(self.HTTPSDomainURL())
        self.features.append(self.RequestURL())
        self.features.append(self.AnchorURL())
        self.features.append(self.LinksInScriptTags())
        self.features.append(self.ServerFormHandler())
        self.features.append(self.InfoEmail())
        self.features.append(self.AbnormalURL())
        self.features.append(self.WebsiteForwarding())
        self.features.append(self.StatusBarCust())

        self.features.append(self.DisableRightClick())
        self.features.append(self.UsingPopupWindow())
        self.features.append(self.IframeRedirection())
        self.features.append(self.AgeofDomain())
        self.features.append(self.DNSRecording())
        self.features.append(self.WebsiteTraffic())
        self.features.append(self.PageRank())
        self.features.append(self.GoogleIndex())
        self.features.append(self.LinksPointingToPage())
        self.features.append(self.StatsReport())


    # 1.UsingIp
    def UsingIp(self):
        try:
            ipaddress.ip_address(self.url)
            return -1
        except:
            return 1

    # 2.longUrl
    def longUrl(self):
        if len(self.url) < 54:
            return 1
        if len(self.url) >= 54 and len(self.url) <= 75:
            return 0
        return -1

    # 3.shortUrl
    def shortUrl(self):
        match =
re.search('bit\.ly|goo\.gl|shorte\.st|go2l\.ink|x\.co|ow\.ly|t\.co|tinyurl|tr\.im|is\.g
d|cli\.gs|'
```

```
'yfrog\.com|migre\.me|ff\.im|tiny\.cc|url4\.eu|twit\.ac|su\.pr|twurl\.nl|snipurl\.com|'

'short\.to|BudURL\.com|ping\.fm|post\.ly|Just\.as|bkite\.com|snipr\.com|fic\.kr|loopt\.
us|'

'doiop\.com|short\.ie|kl\.am|wp\.me|rubyurl\.com|om\.ly|to\.ly|bit\.do|t\.co|lnkd\.in|'

'db\.tt|qr\.ae|adf\.ly|goo\.gl|bitly\.com|cur\.lv|tinyurl\.com|ow\.ly|bit\.ly|ity\.im|'

'q\.gs|is\.gd|po\.st|bc\.vc|twitthis\.com|u\.to|j\.mp|buzurl\.com|cutt\.us|u\.bb|yourls
\.org|'

'x\.co|prettylinkpro\.com|scrnch\.me|filoops\.info|vzturl\.com|qr\.net|1url\.com|tweez\
.me|v\.gd|tr\.im|link\.zip\.net', self.url)
        if match:
            return -1
        return 1

    # 4.Symbol@
    def symbol(self):
        if re.findall("@",self.url):
            return -1
        return 1

    # 5.Redirecting//
    def redirecting(self):
        if self.url.rfind('//')>6:
            return -1
        return 1

    # 6.prefixSuffix
    def prefixSuffix(self):
        try:
            match = re.findall('\-', self.domain)
            if match:
                return -1
            return 1
        except:
            return -1

    # 7.SubDomains
    def SubDomains(self):
        dot_count = len(re.findall("\.", self.url))
        if dot_count == 1:
            return 1
        elif dot_count == 2:
            return 0
        return -1

    # 8.HTTPS
    def Hppts(self):
        try:
            https = self.urlparse.scheme
            if 'https' in https:
                return 1
            return -1
        except:
            return 1

    # 9.DomainRegLen
    def DomainRegLen(self):
        try:
```

```
            expiration_date = self.whois_response.expiration_date
            creation_date = self.whois_response.creation_date
            try:
                if(len(expiration_date)):
                    expiration_date = expiration_date[0]
            except:
                pass
            try:
                if(len(creation_date)):
                    creation_date = creation_date[0]
            except:
                pass

            age = (expiration_date.year-creation_date.year)*12+ (expiration_date.month-
creation_date.month)
            if age >=12:
                return 1
            return -1
        except:
            return -1

    # 10. Favicon
    def Favicon(self):
        try:
            for head in self.soup.find_all('head'):
                for head.link in self.soup.find_all('link', href=True):
                    dots = [x.start(0) for x in re.finditer('\.', head.link['href'])]
                    if self.url in head.link['href'] or len(dots) == 1 or domain in
head.link['href']:
                        return 1
            return -1
        except:
            return -1

    # 11. NonStdPort
    def NonStdPort(self):
        try:
            port = self.domain.split(":")
            if len(port)>1:
                return -1
            return 1
        except:
            return -1

    # 12. HTTPSDomainURL
    def HTTPSDomainURL(self):
        try:
            if 'https' in self.domain:
                return -1
            return 1
        except:
            return -1

    # 13. RequestURL
    def RequestURL(self):
        try:
            for img in self.soup.find_all('img', src=True):
                dots = [x.start(0) for x in re.finditer('\.', img['src'])]
                if self.url in img['src'] or self.domain in img['src'] or len(dots) ==
1:
                    success = success + 1
                i = i+1
```

```
            for audio in self.soup.find_all('audio', src=True):
                dots = [x.start(0) for x in re.finditer('\.', audio['src'])]
                if self.url in audio['src'] or self.domain in audio['src'] or len(dots)
== 1:
                    success = success + 1
                i = i+1

            for embed in self.soup.find_all('embed', src=True):
                dots = [x.start(0) for x in re.finditer('\.', embed['src'])]
                if self.url in embed['src'] or self.domain in embed['src'] or len(dots)
== 1:
                    success = success + 1
                i = i+1

            for iframe in self.soup.find_all('iframe', src=True):
                dots = [x.start(0) for x in re.finditer('\.', iframe['src'])]
                if self.url in iframe['src'] or self.domain in iframe['src'] or
len(dots) == 1:
                    success = success + 1
                i = i+1

            try:
                percentage = success/float(i) * 100
                if percentage < 22.0:
                    return 1
                elif((percentage >= 22.0) and (percentage < 61.0)):
                    return 0
                else:
                    return -1
            except:
                return 0
        except:
            return -1

    # 14. AnchorURL
    def AnchorURL(self):
        try:
            i,unsafe = 0,0
            for a in self.soup.find_all('a', href=True):
                if "#" in a['href'] or "javascript" in a['href'].lower() or "mailto" in
a['href'].lower() or not (url in a['href'] or self.domain in a['href']):
                    unsafe = unsafe + 1
                i = i + 1

            try:
                percentage = unsafe / float(i) * 100
                if percentage < 31.0:
                    return 1
                elif ((percentage >= 31.0) and (percentage < 67.0)):
                    return 0
                else:
                    return -1
            except:
                return -1

        except:
            return -1

    # 15. LinksInScriptTags
    def LinksInScriptTags(self):
        try:
            i,success = 0,0
```

```
            for link in self.soup.find_all('link', href=True):
                dots = [x.start(0) for x in re.finditer('\.', link['href'])]
                if self.url in link['href'] or self.domain in link['href'] or len(dots)
== 1:
                    success = success + 1
                i = i+1

            for script in self.soup.find_all('script', src=True):
                dots = [x.start(0) for x in re.finditer('\.', script['src'])]
                if self.url in script['src'] or self.domain in script['src'] or
len(dots) == 1:
                    success = success + 1
                i = i+1

            try:
                percentage = success / float(i) * 100
                if percentage < 17.0:
                    return 1
                elif((percentage >= 17.0) and (percentage < 81.0)):
                    return 0
                else:
                    return -1
            except:
                return 0
        except:
            return -1

    # 16. ServerFormHandler
    def ServerFormHandler(self):
        try:
            if len(self.soup.find_all('form', action=True))==0:
                return 1
            else :
                for form in self.soup.find_all('form', action=True):
                    if form['action'] == "" or form['action'] == "about:blank":
                        return -1
                    elif self.url not in form['action'] and self.domain not in
form['action']:
                        return 0
                    else:
                        return 1
        except:
            return -1

    # 17. InfoEmail
    def InfoEmail(self):
        try:
            if re.findall(r"[mail\(\)|mailto:?]", self.soap):
                return -1
            else:
                return 1
        except:
            return -1

    # 18. AbnormalURL
    def AbnormalURL(self):
        try:
            if self.response.text == self.whois_response:
                return 1
            else:
                return -1
        except:
            return -1
```

```
# 19. WebsiteForwarding
def WebsiteForwarding(self):
    try:
        if len(self.response.history) <= 1:
            return 1
        elif len(self.response.history) <= 4:
            return 0
        else:
            return -1
    except:
         return -1

# 20. StatusBarCust
def StatusBarCust(self):
    try:
        if re.findall("<script>.+onmouseover.+</script>", self.response.text):
            return 1
        else:
            return -1
    except:
         return -1

# 21. DisableRightClick
def DisableRightClick(self):
    try:
        if re.findall(r"event.button ?== ?2", self.response.text):
            return 1
        else:
            return -1
    except:
         return -1

# 22. UsingPopupWindow
def UsingPopupWindow(self):
    try:
        if re.findall(r"alert\(", self.response.text):
            return 1
        else:
            return -1
    except:
         return -1

# 23. IframeRedirection
def IframeRedirection(self):
    try:
        if re.findall(r"[<iframe>|<frameBorder>]", self.response.text):
            return 1
        else:
            return -1
    except:
         return -1

# 24. AgeofDomain
def AgeofDomain(self):
    try:
        creation_date = self.whois_response.creation_date
        try:
            if(len(creation_date)):
                creation_date = creation_date[0]
        except:
            pass
```

```
            today  = date.today()
            age = (today.year-creation_date.year)*12+(today.month-creation_date.month)
            if age >=6:
                return 1
            return -1
        except:
            return -1

    # 25. DNSRecording
    def DNSRecording(self):
        try:
            creation_date = self.whois_response.creation_date
            try:
                if(len(creation_date)):
                    creation_date = creation_date[0]
            except:
                pass

            today  = date.today()
            age = (today.year-creation_date.year)*12+(today.month-creation_date.month)
            if age >=6:
                return 1
            return -1
        except:
            return -1

    # 26. WebsiteTraffic
    def WebsiteTraffic(self):
        try:
            rank =
BeautifulSoup(urllib.request.urlopen("http://data.alexa.com/data?cli=10&dat=s&url=" +
url).read(), "xml").find("REACH")['RANK']
            if (int(rank) < 100000):
                return 1
            return 0
        except :
            return -1

    # 27. PageRank
    def PageRank(self):
        try:
            prank_checker_response =
requests.post("https://www.checkpagerank.net/index.php", {"name": self.domain})

            global_rank = int(re.findall(r"Global Rank: ([0-9]+)",
rank_checker_response.text)[0])
            if global_rank > 0 and global_rank < 100000:
                return 1
            return -1
        except:
            return -1


    # 28. GoogleIndex
    def GoogleIndex(self):
        try:
            site = search(self.url, 5)
            if site:
                return 1
            else:
                return -1
        except:
            return 1
```

```
    # 29. LinksPointingToPage
    def LinksPointingToPage(self):
        try:
            number_of_links = len(re.findall(r"<a href=", self.response.text))
            if number_of_links == 0:
                return 1
            elif number_of_links <= 2:
                return 0
            else:
                return -1
        except:
            return -1

    # 30. StatsReport
    def StatsReport(self):
        try:
            url_match = re.search(

'at\.ua|usa\.cc|baltazarpresentes\.com\.br|pe\.hu|esy\.es|hol\.es|sweddy\.com|myjino\.r
u|96\.lt|ow\.ly', url)
            ip_address = socket.gethostbyname(self.domain)
            ip_match =
re.search('146\.112\.61\.108|213\.174\.157\.151|121\.50\.168\.88|192\.185\.217\.116|78\
.46\.211\.158|181\.174\.165\.13|46\.242\.145\.103|121\.50\.168\.40|83\.125\.22\.219|46\
.242\.145\.98|'

'107\.151\.148\.44|107\.151\.148\.107|64\.70\.19\.203|199\.184\.144\.27|107\.151\.148\.
108|107\.151\.148\.109|119\.28\.52\.61|54\.83\.43\.69|52\.69\.166\.231|216\.58\.192\.22
5|'

'118\.184\.25\.86|67\.208\.74\.71|23\.253\.126\.58|104\.239\.157\.210|175\.126\.123\.21
9|141\.8\.224\.221|10\.10\.10\.10|43\.229\.108\.32|103\.232\.215\.140|69\.172\.201\.153
|'

'216\.218\.185\.162|54\.225\.104\.146|103\.243\.24\.98|199\.59\.243\.120|31\.170\.160\.
61|213\.19\.128\.77|62\.113\.226\.131|208\.100\.26\.234|195\.16\.127\.102|195\.16\.127\
.157|'

'34\.196\.13\.28|103\.224\.212\.222|172\.217\.4\.225|54\.72\.9\.51|192\.64\.147\.141|19
8\.200\.56\.183|23\.253\.164\.103|52\.48\.191\.26|52\.214\.197\.72|87\.98\.255\.18|209\
.99\.17\.27|'

'216\.38\.62\.18|104\.130\.124\.96|47\.89\.58\.141|78\.46\.211\.158|54\.86\.225\.156|54
\.82\.156\.19|37\.157\.192\.102|204\.11\.56\.48|110\.34\.231\.42', ip_address)
            if url_match:
                return -1
            elif ip_match:
                return -1
            return 1
        except:
            return 1

    def getFeaturesList(self):
        return self.features
```

index.html

```
<!DOCTYPE html>

<html lang="en">
```

```
<head>
    <meta charset="UTF-8">
    <meta name="viewport" content="width=device-width, initial-scale=1.0">
    <title>Hook</title>
    <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/shorthandcss@1.1.1/dist/shorthand.min.css"
/>
    <link rel="stylesheet"
href="https://fonts.googleapis.com/css?family=Muli:200,300,400,500,600,700,800,
900&display=swap" />
    <link rel="stylesheet" type="text/css"
        href="https://cdnjs.cloudflare.com/ajax/libs/slick-
carousel/1.9.0/slick.min.css" />
    <link rel="stylesheet" type="text/css" href="//cdn.jsdelivr.net/npm/slick-
carousel@1.8.1/slick/slick-theme.css" />
</head>

<body class="bg-black muli">
    <nav class="w-100pc flex flex-column md-flex-row md-px-10 py-5 bg-black">
        <div class="flex justify-between">
            <a href="#" class="flex items-center p-2 mr-4 no-underline">
                <img class="max-h-l2 w-auto" src="assets/images/logo.png" />
            </a>
            <a data-toggle="toggle-nav" data-target="#nav-items" href="#"
                class="flex items-center ml-auto md-hidden indigo-lighter
opacity-50 hover-opacity-100 ease-300 p-1 m-3">
                <i data-feather="menu"></i>
            </a>
        </div>
        <div id="nav-items" class="hidden flex sm-w-100pc flex-column md-flex
md-flex-row md-justify-end items-center">
            <a href="#home" class="fs-s1 mx-3 py-3 indigo no-underline hover-
underline">Home</a>
            <a href="#features" class="fs-s1 mx-3 py-3 indigo no-underline
hover-underline">Features</a>
            <a href="#team" class="fs-s1 mx-3 py-3 indigo no-underline hover-
underline">Team</a>
        </div>
    </nav>
```

```
    <!-- hero section -->
    <section id="home" class="min-h-100vh flex justify-start items-center">


        <div class="mx-5 md-mx-l5">
            <div class="inline-block br-round bg-indigo-30 indigo-lightest p-2
fs-s2 mb-5">
                <div class="inline-block bg-indigo indigo-lightest br-round px-
3 py-1 mr-3 fs-s3">Konw More About Us</div>Hook is a website designed to
protect our data and sensitive information from malicious attacks and maintain
confidentiality.
            </div>
            <div>
                <h1 class="white fs-l3 lh-2 md-fs-xl1 md-lh-1 fw-900 ">Secure
Your <br />Website Fast</h1>



                <div class="br-8 mt-10 inline-flex">
                    <form action="/" method ="post">
                    <input type="text"
                        class="input-lg half bw-0 fw-200 bg-indigo-lightest-10
white ph-indigo-lightest focus-white opacity-80 fs-s3 py-5 min-w-25vw br-r-0"
                        class="form__input" name ='url' id="url"
                        placeholder="Enter URL" required="" />
                    <button
                        class="button-lg bg-indigo-lightest-20 indigo-lightest
focus-white fw-300 fs-s3 mr-0 br-l-0" role="button">Detect</button>
                    </form>
                </div>
                <div class="white opacity-20 fs-s3 mt-
3">eg:(https://google.com)</span>
            </div>
            <div class="col-md" id="form2">


                <br>
                <h6 class = "right "><a href= {{ url }} target="_blank">{{ url
}}</a></h6>
```

```
                <br>
                <h3 id="prediction"></h3>
                <button class="button2" id="button2" role="button"
onclick="window.open('{{url}}')" target="_blank" >Still want to
Continue</button>
                <button class="button1" id="button1" role="button"
onclick="window.open('{{url}}')" target="_blank">Continue</button>
            </div>
        </div>
    </section>

    <script>

        let x = '{{xx}}';
        let num = x*100;
        if (0<=x && x<0.50){
            num = 100-num;
        }
        let txtx = num.toString();
        if(x<=1 && x>=0.50){
            var label = ("Website is "+txtx +"% safe to use...");
            document.getElementById("prediction").style.color = "white";
            document.getElementById("prediction").innerHTML = label;
            document.getElementById("button1").style.display="block";
        }
        else if (0<=x && x<0.50){
            var label = ("Website is "+txtx +"% unsafe to use...");
            document.getElementById("prediction").style.color = "white";
            document.getElementById("prediction").innerHTML = label ;
            document.getElementById("button2").style.display="block";
        }

</script>
```

```
    <!-- features -->
    <section id="features" class="p-10 md-p-l5">
        <div class="flex flex-column md-flex-row mx-auto">
            <div class="w-100pc md-w-40pc">
                <div class="br-8 p-5 m-5">
                    <div class="flex justify-center items-center bg-indigo-
lightest-10 white w-l5 h-l5 br-round mb-5"><i
                            data-feather="inbox" class="w-l5"></i></div>
                    <h4 class="white fw-600 fs-m3 mb-5">URL-Based Features</h4>
                    <div class="indigo-lightest fw-600 fs-m1 lh-3 opacity-
50">URL is the first thing to analyse a website to decide whether it is a
phishing or not. As we mentioned before, URLs of phishing domains have some
distinctive points. Features which are related to these points are obtained
when the URL is processed.</div>
                    <a href="#"
                        class="mt-5 button bg-indigo-lightest-10 fs-s3 white
no-underline hover-opacity-100 hover-scale-up-1 ease-300">Read</a>
                </div>
            </div>
            <div class="w-100pc md-w-40pc">
                <div class="br-8 p-5 m-5">
                    <div class="flex justify-center items-center bg-indigo-
lightest-10 white w-l5 h-l5 br-round mb-5"><i
                            data-feather="cpu" class="w-l5"></i></div>
                    <h4 class="white fw-600 fs-m3 mb-5">Domain-Based
Features</h4>
                    <div class="indigo-lightest fw-600 fs-m1 opacity-50">The
purpose of Phishing Domain Detection is detecting phishing domain names.
Therefore, passive queries related to the domain name, which we want to
classify as phishing or not, provide useful information to us.</div>
                    <a href="#"
                        class="mt-5 button bg-indigo-lightest-10 fs-s3 white
no-underline hover-opacity-100 hover-scale-up-1 ease-300">Read</a>
                </div>
            </div>
            <div class="w-100pc md-w-40pc">
                <div class="br-8 p-5 m-5">
                    <div class="flex justify-center items-center bg-indigo-
lightest-10 white w-l5 h-l5 br-round mb-5"><i
                            data-feather="database" class="w-l5"></i></div>
```

```
                    <h4 class="white fw-600 fs-m3 mb-5">Page-Based
Features</h4>

                    <div class="indigo-lightest fw-600 fs-m1 opacity-50">Page-
Based Features are using information about pages which are calculated
reputation ranking services. Some of these features give information about how
much reliable a web site is. </div>

                    <a href="#"

                        class="mt-5 button bg-indigo-lightest-10 fs-s3 white
no-underline hover-opacity-100 hover-scale-up-1 ease-300">Read</a>

                </div>

            </div>

        </div>

    </section>


    <!-- slider -->

    <section class="relative bg-indigo-lightest-10">

        <div id="slider-1">

            <div class="p-10 md-p-l10 flex justify-center items-center flex-
column text-center">

                <h2 class="white fs-l3 fw-900">Some of URL-Based Features are
given below.</h2>

                <p class="indigo-lightest fw-600 fs-m1 opacity-30 my-5">Digit
count in the URL

                    Total length of URL -

                    Checking whether the URL is Typosquatted or not.
(google.com → goggle.com) -

                    Checking whether it includes a legitimate brand name or not
(apple-icloud-login.com) -

                    Number of subdomains in URL -

                    Is Top Level Domain (TLD) one of the commonly used one?</p>

                <a href="#" class="button-md bg-indigo white fs-s3 br-4 black
fw-600 no-underline m-5">READ MORE</a>

            </div>

            <div class="p-10 md-p-l10 flex justify-center items-center flex-
column text-center">

                <h2 class="white fs-l3 fw-900">Some useful Domain-Based
Features are given below.</h2>

                <p class="indigo-lightest fw-600 fs-m1 opacity-30 my-5">Its
domain name or its IP address in blacklists of well-known reputation services?
-

                    How many days passed since the domain was registered? -
```

```
                    Is the registrant name hidden? </p>
                <a href="#" class="button-md bg-indigo white fs-s3 br-4 black
fw-600 no-underline m-5">READ MORE</a>
            </div>
            <div class="p-10 md-p-l10 flex justify-center items-center flex-
column text-center">
                <h2 class="white fs-l3 fw-900">Some of Page-Based Features are
given below.</h2>
                <p class="indigo-lightest fw-600 fs-m1 opacity-30 my-5">Global
Pagerank -
                    Country Pagerank -
                    Position at the Alexa Top 1 Million Site -
                    Average Pageviews per visit -
                    Average Visit Duration -
                    Web traffic share per country</p>
                <a href="#" class="button-md bg-indigo white fs-s3 br-4 black
fw-600 no-underline m-5">READ MORE</a>
            </div>
        </div>
        <ul class="absolute list-none w-100pc flex justify-between top-50pc">
            <li><button
                    class="prev ml-10 br-round border-indigo-lightest indigo-
lightest  bg-transparent flex justify-center items-center p-2 focus-indigo-
lighter outline-none"><i
                        data-feather="chevron-left"></i></button></li>
            <li><button
                    class="next mr-10 br-round border-indigo-lightest indigo-
lightest  bg-transparent flex justify-center items-center p-2  focus-indigo-
lighter outline-none"><i
                        data-feather="chevron-right"></i></button></li>
        </ul>
    </section>

    <!-- big text -->
    <section class="p-10 md-py-10">
        <div class="w-100pc md-w-70pc mx-auto py-10">
            <h2 class="white fs-12 md-fs-xl1 fw-900 lh-2 ">we'll detect the
                <span class="border-b bc-indigo bw-4"> website </span>
                for you.</h2>
```

```
        </div>
    </section>


    <!-- product options -->
    <section id="team" class="min-h-100vh flex justify-start items-center">
    <section class="py-l10">
        <div class="flex flex-column md-flex-row md-w-80pc mx-auto">
            <div class="w-100pc md-w-50pc">
                <div class="br-8 p-5 m-5 bg-indigo-lightest-10 pointer hover-
scale-up-1 ease-300">
                    <div class="inline-block bg-indigo indigo-lightest br-3 px-
4 py-1 mb-10 fs-s4 uppercase">
                        Team Leader</div>
                    <div class="indigo-lightest fw-600 fs-m1">Nitish
Kumar<br><span class="opacity-30"> Github Profile Link -
https://github.com/Nitishar1</link></span> </div>
                    <a href="#" class="mt-10 button bg-black fs-s3 white no-
underline">Read</a>
                </div>
            </div>
            <div class="w-100pc md-w-50pc">
                <div class="br-8 p-5 m-5 bg-indigo-lightest-10  pointer hover-
scale-up-1 ease-300">
                    <div class="inline-block bg-indigo indigo-lightest br-3 px-
4 py-1 mb-10 fs-s4 uppercase">
                        Team Member</div>
                    <div class="indigo-lightest fw-600 fs-m1">Lokesh Kannan
<span class="opacity-30"> Github Profile Link - https://github.com/ </span>
</div>
                    <a href="#" class="mt-10 button bg-black fs-s3 white no-
underline">Read</a>


                </div>
            </div>
            <div class="w-100pc md-w-50pc">
                <div class="br-8 p-5 m-5 bg-indigo-lightest-10 pointer hover-
scale-up-1 ease-300">
                    <div class="inline-block bg-indigo indigo-lightest br-3 px-
4 py-1 mb-10 fs-s4 uppercase">
                        Team Member</div>
```

```
                    <div class="indigo-lightest fw-600 fs-m1">Karthik<br><span
class="opacity-30"> Github Profile Link</link>https://github.com/</span> </div>
                    <a href="#" class="mt-10 button bg-black fs-s3 white no-
underline">Read</a>
                </div>
            </div>


            <div class="w-100pc md-w-50pc">
                <div class="br-8 p-5 m-5 bg-indigo-lightest-10 pointer hover-
scale-up-1 ease-300">
                    <div class="inline-block bg-indigo indigo-lightest br-3 px-
4 py-1 mb-10 fs-s4 uppercase">
                        Team Member</div>
                    <div class="indigo-lightest fw-600 fs-m1">Hari<br><span
class="opacity-30"> Github Profile Link</link>https://github.com/</span> </div>
                    <a href="#" class="mt-10 button bg-black fs-s3 white no-
underline">Read</a>
                </div>
            </div>


        </div>
    </section>
</section>




    <!-- footer -->
    <footer class="p-5 md-p-l5 bg-indigo-lightest-10">
        <div class="flex flex-wrap">
            <div class="md-w-25pc mb-10">
                <img src="assets/images/logo.png" class="w-l5" alt="">
                <div class="white opacity-70 fs-s2 mt-4 md-pr-10">
                    <p>Copyright © Hook 2022. <br>All rights reserved.</p>


                </div>
            </div>
```

```
    </footer>

    <a class="fixed top-50pc right-0 p-3 bg-indigo white hover-scale-up-1 ease-
300 no-underline" href="https://gum.co/tifJM" target="_blank" >

        <i class="w-4" data-feather="download"></i>

    </div>

    <script src="https://code.jquery.com/jquery-3.4.1.min.js"></script>

    <script src="https://unpkg.com/feather-icons"></script>

    <script src="https://cdnjs.cloudflare.com/ajax/libs/slick-
carousel/1.9.0/slick.min.js"></script>

    <script src="https://cdn.jsdelivr.net/gh/cferdinandi/smooth-
scroll@15.0.0/dist/smooth-scroll.polyfills.min.js"></script>

    <script src="assets/js/script.js"></script>

</body>


</html>
```

GitHub & project demo link:

GitHub link: https://github.com/IBM-EPBL/IBM-Project-2042-1658424437

Demo link: https://github.com/IBM-EPBL/IBM-Project-2042-1658424437/blob/main/Final%20Deliverables/Demo%20Video/Demo%20Video.wmv