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# Covid-19 Vaccination Review System: Challenges & Opportunities

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**ABSTRACT:** Before shutting down the borders and locking down their citizens, all the world leaders down-played the new emerging virus that was sweeping our globe. This was one of our enemies' plots, dragging the countries to a shutdown. Nobody knew that there would be a pandemic of this proportion. But many who worked closely in infectious diseases, knew very well that a pandemic like this was on its way. In terms of the death toll, a pandemic would rival even the gigantic wars of the past. Covid-19 Pandemic has been a major concern for a long time and is still affecting our lives in several ways. Vaccines have become the need of the hour in this global crisis. However, people are still not able to figure out the need of getting vaccinated and are lacking awareness in terms of healthcare technologies. People are not able to build 100% trust for the vaccination centers. This need resulted into an idea of creating such a web application where the shortage of vaccination center review system is covered. Natural Language Processing [NLP] has played the major role for the display of relevant reviews of vaccination centers all over the country. Real time APIs were created to extract relevant information of available centers according to the states and districts. Official government applications like CoWIN and Arogya Setu were referred and compared to bring advancements. The project demonstrates a full fledged system to solve the problem of reviewing a particular center along with all the necessary information of Covid-19 and upcoming turning points on a single platform. The objective of this project is to connect with all the available vaccination centers to improvise the infrastructure and functioning within the centers and among the healthcare professionals.

**KEYWORDS:** Covid-19 Vaccination, Review System, Natural Language Processing, Web Application of Covid-19 Reviews, Machine Learning.

## I. INTRODUCTION

Since past two years, each and every soul has suffered from the impact of this massive Covid-19 pandemic. Extensive researches by each individual is done on a daily basis to figure out how to cope up with this and remain safe. Nowadays, website is the most important tool to build trust among the individuals. For all the information, people directly make a search on google and head towards landing on blogs or web pages. The tools and technologies used to successfully develop this website are Node.JS, Express, MongoDB and JavaScript for the back-end development. For

front-end development HTML, CSS, Bootstrap and JavaScript are used. For Natural Language Processing Python, Tensor.JS and JavaScript are used to implement via Google Colab. Covid Vaccination Review System web application allows a user to gain all the relevant knowledge as per the current world scenario.

Till date, a number of web applications related to Covid-19 are developed which are officially used by the government. For example CoWIN and Arogya Setu. These websites have been very informative for the citizens. This project demonstrates the similar functioning but adding a review system in it. The datasets for Natural Language Processing are taken from twitter datasets. Twitter is the most popular micro-blogging service based platform where each user is capable to create status messages or we can also say tweets. These status messages are a display of different opinions from different users on different topics. The main purpose of this project is to implement such an algorithm where the reviews of each individual are classified into positive or negative and detecting false or abusive reviews. However, to maintain the equality, negative reviews are allowed but abusive or false words are strictly prohibited. This brings the bag of words into account. The bag of words will work like a dictionary where a number of common false abusive words are present so that any type of matching or similar words are automatically deleted. Hence, no further display of abusive comments will be entertained and the person writing that review will not be able to give another review. The concept bag of words is just a part of the project, however the soul objective of this research is the social benefit for the people as well as healthcare vaccination centers.

The rest of this research paper is constructed as follows. Section I provides the literature review in order to vivisect the word previously done. Section II provides the methodology of our proposed project work with relevant figures. Section III provides an insight upon the experimental results. Section IV provides the conclusion and future scope of the project. Fig 1. Shows the entire framework and functioning of the project.

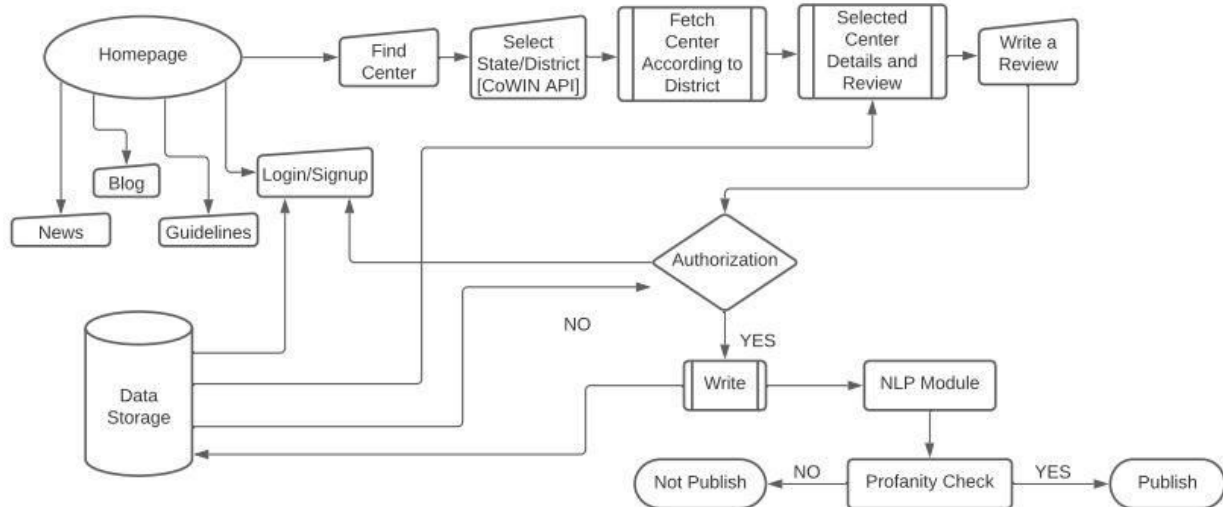


Fig 1. Framework of the Covid Vaccination Review System

The expectations, functioning or the overview of the project is as follows -

- ✓ There are three types of users landing on the website. One who wants to read reviews and book a vaccination slot. Second, who wants to share his or her experience and provide a valuable feedback for a particular center. Third, who landed on the website via blogs just to gain more knowledge for certain guidelines and precautions.
- ✓ A user on visiting the website will be able to view different sections from the Navbar like Finding a center, Review a center, Book a slot, Guidelines, News, Blog and Login/Sign up.
- ✓ A user can hover over the different guidelines and blogs to gain all the knowledge related to Covid - 19 Pandemic and upcoming misfits.
- ✓ A user can look into the latest news and current cases responsive map worldwide in whatever way the user wants by changing the demographics and type of map there itself.
- ✓ A user can read reviews of the preferred vaccination center.
- ✓ A user can search vaccination centers according to the state and district entered.



- ✓ A user can write and share the experience of a particular vaccination center which will be helpful for both people and volunteers of the center.
- ✓ A user can give star reviews to a vaccination center depending on the experience.
- ✓ A user can book a slot depending on the choice of paid or free vaccine.
- ✓ A user cannot write any abusive reviews which violates the laws of authentication

## II. METHODOLOGY

This section gives an overview of our proposed project work step by step for the review system. Different modules used to establish the bag of words and also the web page utilities are explained. The overview architecture of the website contains three main parts: - The Web Page back end module for the fetching of data sources and authorizing them using Node.JS and Mongo DB, The Natural Language Processing Module [NLP] for cleaning and processing reviews with function creations, The front end creation using HTML, CSS and Bootstrap.

Here is the step by step procedure for building a successful Vaccination Review System Website-

### 1. Web Page Build

- Using Node.JS we are running the server of the website. Using HTML, CSS and Bootstrap a user can navigate on the web page.
- Data Fetching Method - By using REST.API we are navigating and by using public route of COWIN API we have fetched the states and districts ids. After successfully selecting the desired state and district, again the center ids for that particular districts are fetched followed by user selection for relevant centers with information such as timing, reviews, vaccination type and different age groups.
- User Authorization Process - It uses local storage which is session and key based followed using passport.js as it is a reliable method for hashing. Since authentication is confidential we have hashed them followed by adding salt.
- Database - Used Mongo DB for databases and for the Queries and connection between NODE.JS and database we have used Mongoose ORM .
- User Data - We are taking inputs as Name which is the primary key, email id which is always unique as a need to login or sign-up for writing a review.
- Model for review - Taking user id and center id to allow both the persons who are there to check reviews as well as to write. After this, we can successfully block those user ids or people with toxic mentality followed by reaching to NLP module using child process which is the node process attaching it with the reviews with stars.

### 2. NLP Module

#### a) Cleaning / Pre-processing of the review

Pre-processing is essential for machine learning models but more important for Natural Language Processing as without it the dataset is just a cluster of words that computer don't understand

- i) First we remove the punctuation from the sentences since we need to remove words and characters which does not give any meaning to the Review
- ii) Then Using the Natural language toolkit we remove the stop words from the sentences which does not help in analysing sentiments of the sentence ex :- in, are, etc
- iii) Perform Stemming i.e. reducing any inflated word into its word stem removing its suffix or prefix. For an example- A word "Flying" has a suffix as "ing", on removing "ing" out-of "Flying" then we will obtain a base word or we can say a root word that is "Fly". This suffix can be used to create a new word out of it's original stem word.

#### b) Function Creation

After cleaning the data we have created a bag of words model which vectorize every word in its root form enabling us to train the computer using any type of classification model to predict whether the review is offensive or not. Fig 2. & Fig 3. Explains the bag of words and training/testing datasets.



```
[9] import re
import nltk
nltk.download('stopwords')
from nltk.corpus import stopwords
from nltk.stem.porter import PorterStemmer
corpus = []
for i in range(0,1000):
    text = re.sub('[^a-zA-Z]', ' ', dataset['text'][i])
    text = text.lower()
    text=text.split()
    ps = PorterStemmer()
    all_stopwords = stopwords.words('english')
    all_stopwords.remove('not')
    text = [ps.stem(word) for word in text if not word in set(all_stopwords)]
    text = ' '.join(text)
    corpus.append(text)

[nltk_data] Downloading package stopwords to /root/nltk_data...
[nltk_data] Unzipping corpora/stopwords.zip.
```

Fig 2.

```
<> ▼ Creating the Bag of Words model
{x} [11] from sklearn.feature_extraction.text import CountVectorizer
cv = CountVectorizer(max_features = 1500)
X = cv.fit_transform(corpus).toarray()
y = dataset.iloc[:1000, 0].values

▼ Splitting the dataset into the Training set and Test set
[12] from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.20, random_state = 0)

▼ Training the Naive Bayes model on the Training set
[13] from sklearn.naive_bayes import GaussianNB
classifier = GaussianNB()
classifier.fit(X_train, y_train)
```

Fig 3.

### III. EXPERIMENTAL RESULTS

After successfully establishing all the modules we have developed a web page for covid vaccination review system which meets all the functioning of the proposed project. Allowing users to responsively navigate through the website, find vaccination centers and write/read reviews for them. We have developed a web server which will host the website, store and fetch data using different API, store user data of those people who will write a review. We have compiled the NLP module to flag the offensive language within the reviews and strictly prohibit them for publishing. Trained NLP module with test cases of around 10000 reviews. Evaluation of module on an ideal test dataset of twitter and Wikipedia reviews was done where we received the accuracy of 93%. Fig 4. Shows the accuracy result of the module evaluation.



```
▼ Predicting the Test results
[11] print(X_test)
     y_pred =classifier.predict(X_test)
     print(np.concatenate((y_pred.reshape(len(y_pred),1), y_test.reshape(len(y_test),1)),1))

[[0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 ...
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]
 [0 0 0 ... 0 0 0]]
[[0 0]
 [0 0]
 [0 0]
 ...
 [0 1]
 [1 1]
 [0 0]]

▼ Making the Confusion Matrix
from sklearn.metrics import confusion_matrix, accuracy_score
cm = confusion_matrix(y_test, y_pred)
print(cm)
accuracy_score(y_test, y_pred)

[[1604   8]
 [ 120 268]]
0.936
```

Fig 4. Accuracy result

Homepage :



Fig 5. Homepage of the website

#### IV. CONCLUSION

Covid Vaccination Review System falls under the category of healthcare improvement and spreading awareness among people. Reviews playing an essential role in our day to day life needs to be tested to make sure only relevant information is shared between people. Such websites can be helpful for contributing in a healthcare industry where ethics and technology go hand in hand. Vaccination is the need of hour for each individual. However, any type of carelessness is a big risk towards one's health. This website is a full-fledged system for finding centers, reviewing them, reading reviews, blocking abusive reviews, gaining knowledge, creating account, connecting with centers so that they can improvise and most important booking a vaccination slot.



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