TASK-PROGESS REPORT

IMPLEMENTING WEB APPLICATION

CREATE IBM DB2 AND CONNECT WITH PYTHON

Date	15 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

STEP 1: Import the ibm_db Python library:

```
!pip install --force-reinstall ibm_db==3.1.0
ibm_db_sa==0.3.7
importibm_db
```

STEP 2: Identify the database connection credentials:

```
dsn_hostname = "2d46b6b4-cbf6-40eb-
bbce- 6251e6ba0300.bs2io90l08kqb1od8lcg.databases.appdomain.cloud"

dsn_uid = "vjd29721"
dsn_pwd = "6TTgx8MRBzT45o3q"
dsn_driver = "{IBM DB2 ODBC DRIVER}"
dsn_database = "BLUDB"# e.g. "BLUDB"
dsn_port = "32328"       # e.g. "32733"
dsn_protocol = "TCPIP"# i.e. "TCPIP"
dsn_security = "SSL" #i.e. "SSL"
```

STEP 3:Create the DB2 database connection:

```
dsn = (

   "DRIVER={0};"
```

```
   "DATABASE={1};"

   "HOSTNAME={2};"

   "PORT={3};"

   "PROTOCOL={4};"

   "UID={5};"

   "PWD={6};"

   "SECURITY={7};").format(dsn_driver, dsn_database, dsn_hostname, dsn_port,
dsn_protocol,dsn_uid, dsn_pwd,dsn_security) print(dsn)
```

Now establish the connection to the database:

```
conn = ibm_db.connect(dsn, "", "")
print ("Connected to database: ", dsn_database, "as user:",dsn_uid,
"on host: ",dsn_hostname)
```

except:

```
   print ("Unable to connect:", ibm_db.conn_errormsg() )
server = ibm_db.server_info(conn)


print("DBMS_NAME:",server.DBMS_NAME)
print ("DBMS_VER:",  server.DBMS_VER)
 print ("DB_NAME:", server.DB_NAME)

client = ibm_db.client_info(conn)
print("DRIVER_NAME:",client.DRIVER_NAME)
print("DRIVER_VER:",client.DRIVER_VER)
print("DATA_SOURCE_NAME:",client.DATA_SOURCE_NAME)
print("DRIVER_ODBC_VER:",client.DRIVER_ODBC_VER)
print ("ODBC_VER:", client.ODBC_VER)
print ("ODBC_SQL_CONFORMANCE: ", client.ODBC_SQL_CONFOR
MANCE)

print ("APPL_CODEPAGE: ", client.APPL_CODEPAGE)
print("CONN_CODEPAGE:", client.CONN_CODEPAGE)
```

STEP 4: Close the Connection:

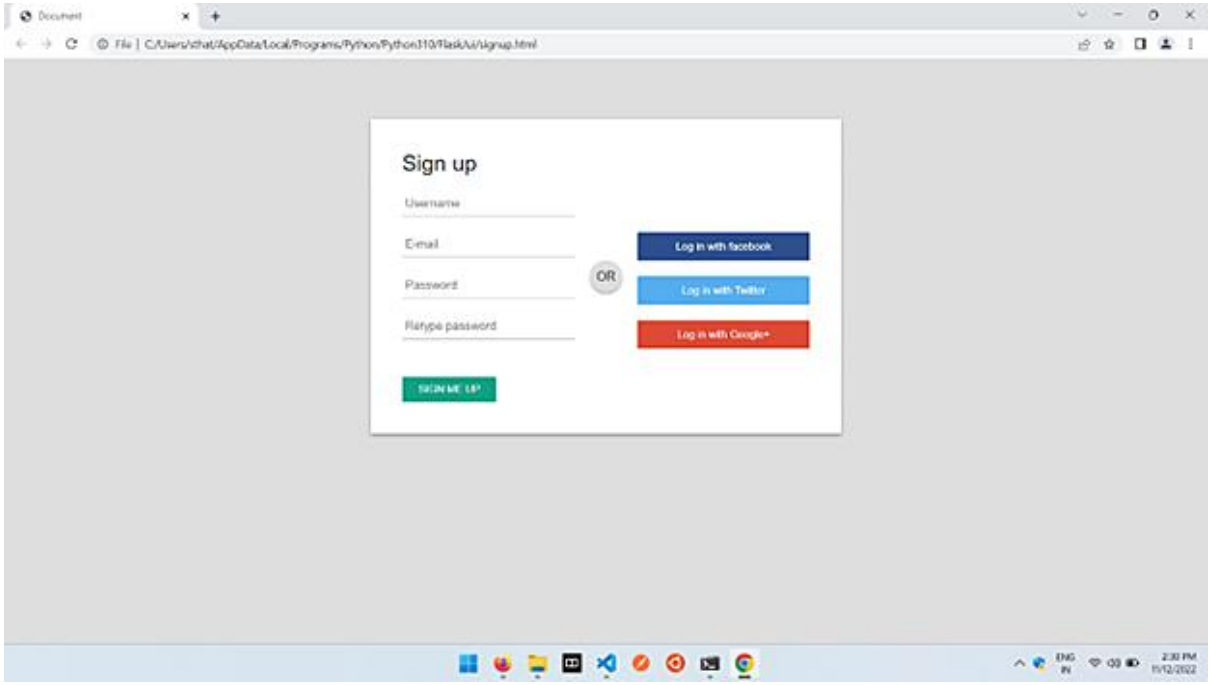
ibm_db.close(conn)

IMPLEMENTING WEB APPLICATION

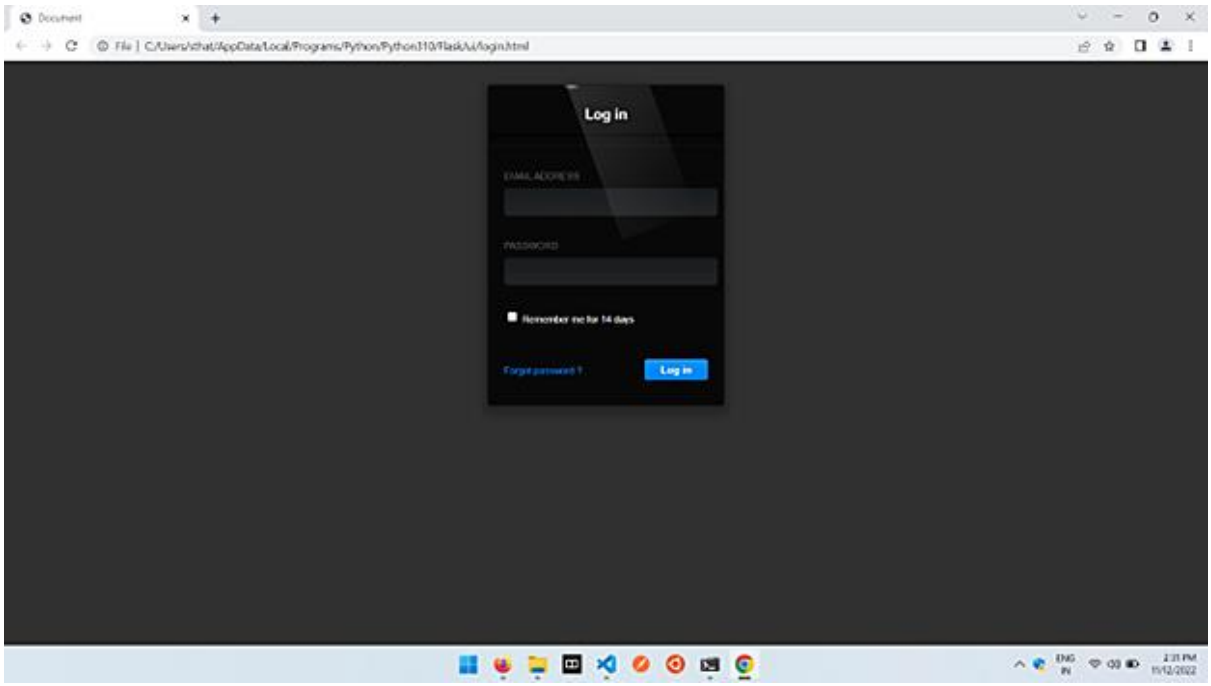
Create UI to Interact with Application

Date	12 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Step 1: Sign up



Step 2: Login Page

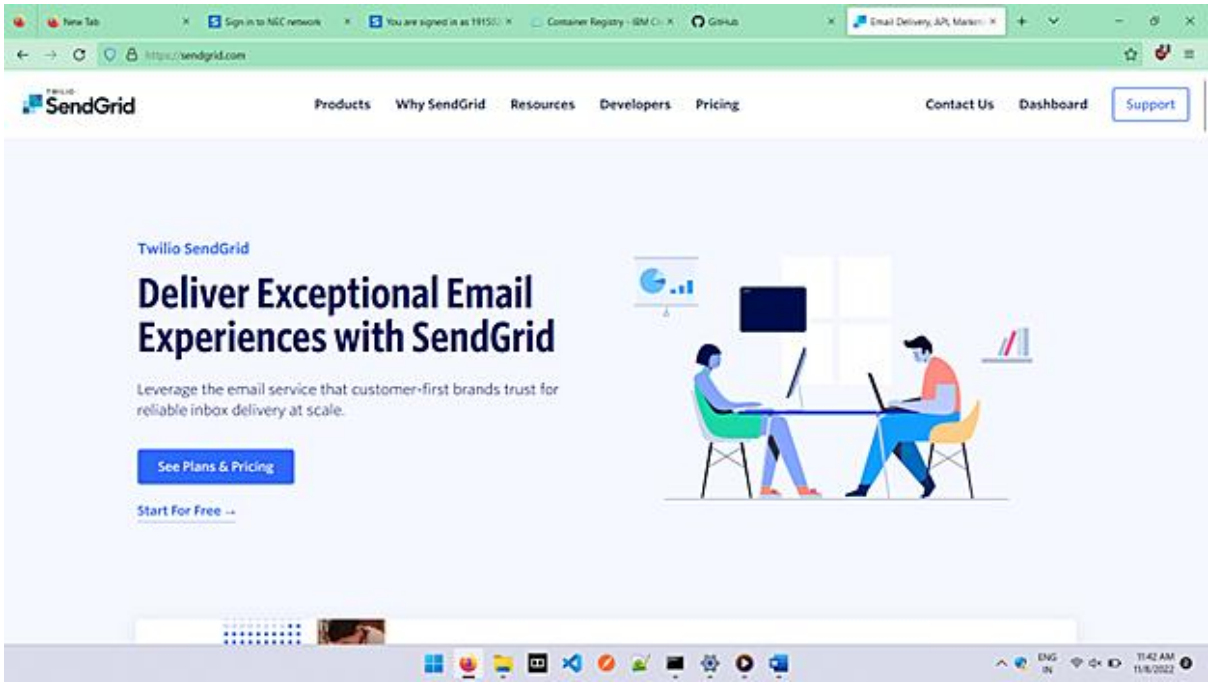


SETITNG UP APPLICATION ENVIRONMENT

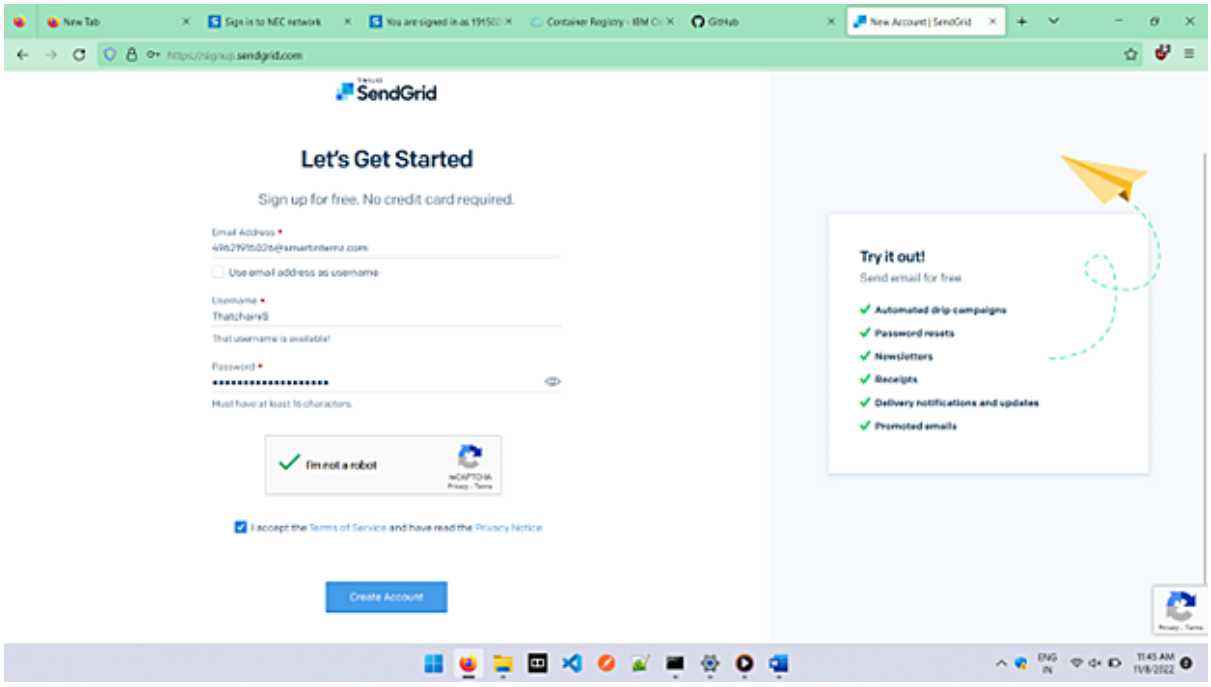
Create an Account in Send Grid

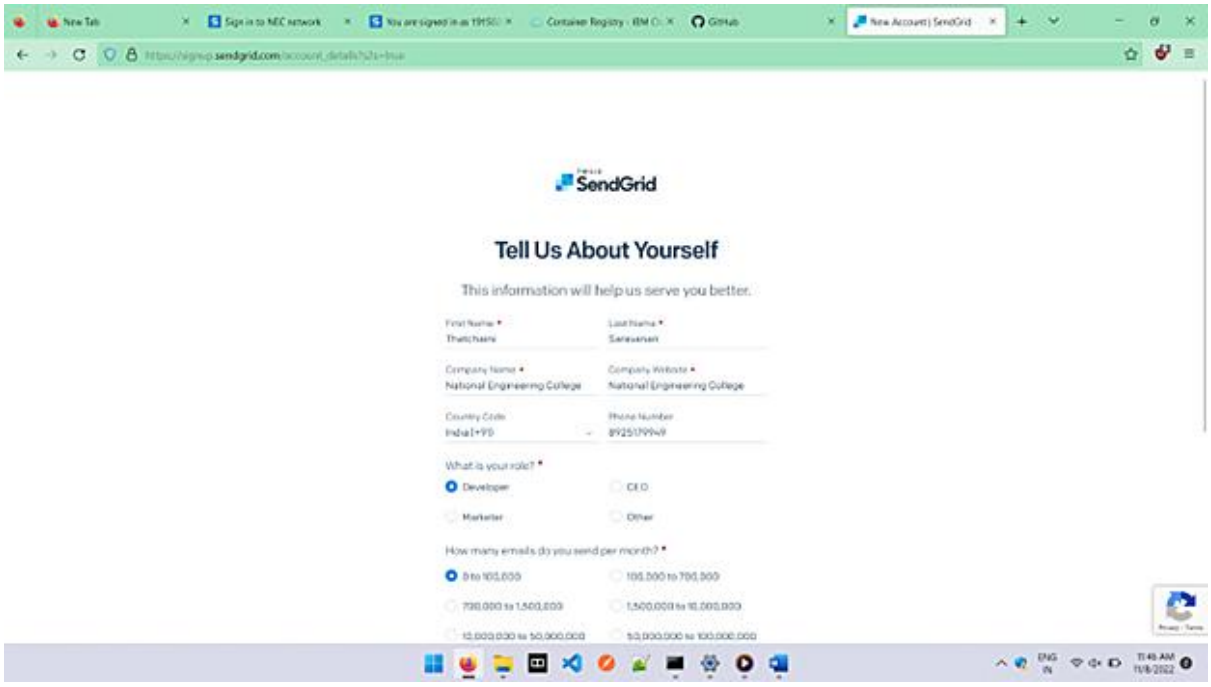
Date	08 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Step 1: Navigate to https://sendgrid.com



Step 2: Click on start for free and register yourselves by entering required details and click on create account





Output:

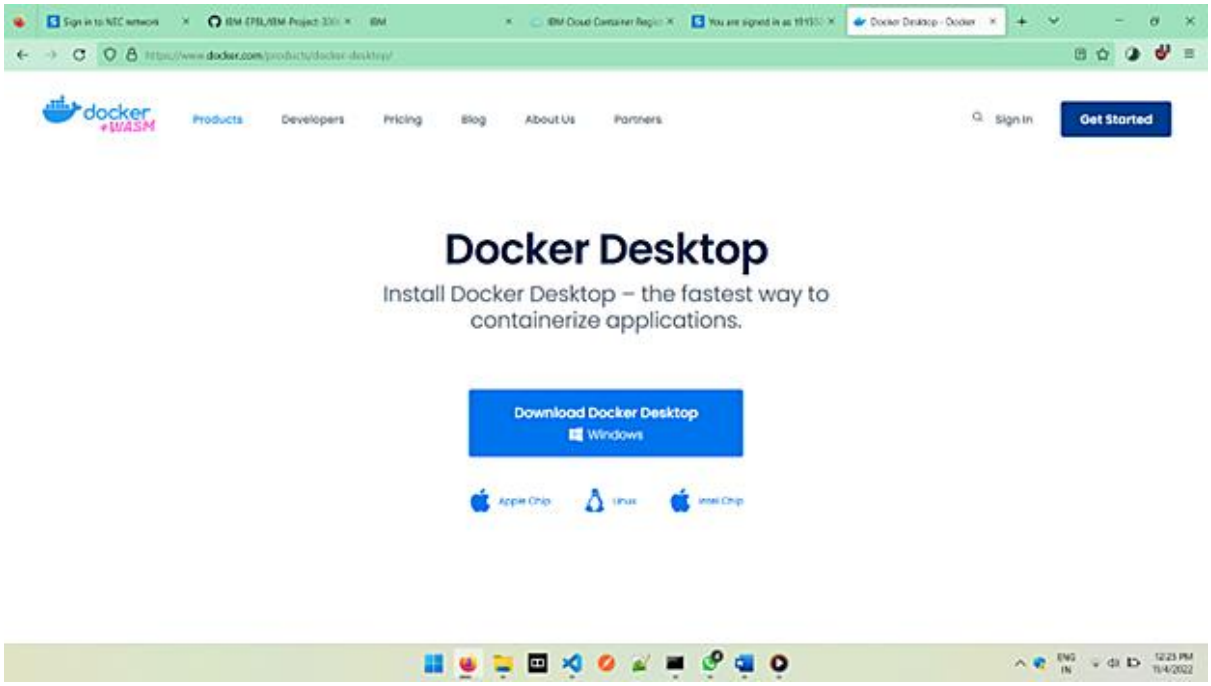
SendGrid account created successfully.

SETITNG UP APPLICATION ENVIRONMENT

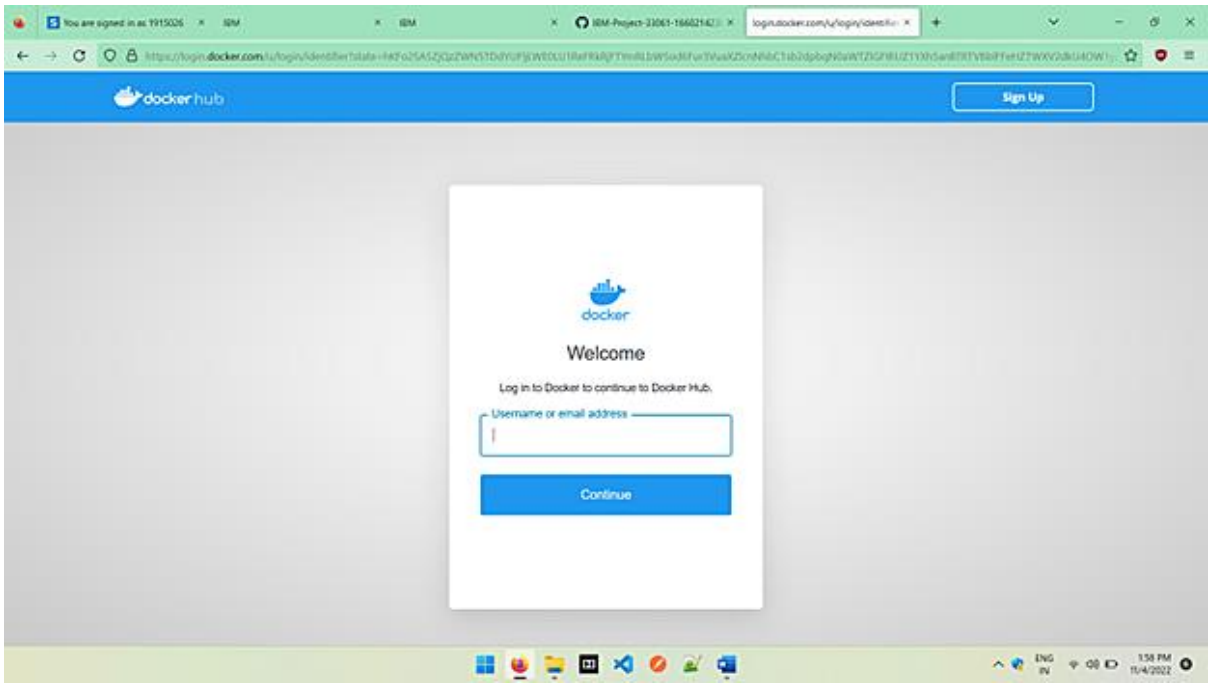
Docker CLI Installation

Date	07 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Step 1: Download Docker from docker.com and install it by running the docker Desktop installer.exe file



Step 2: Go to hub.docker.com register and create an account and login with the same.

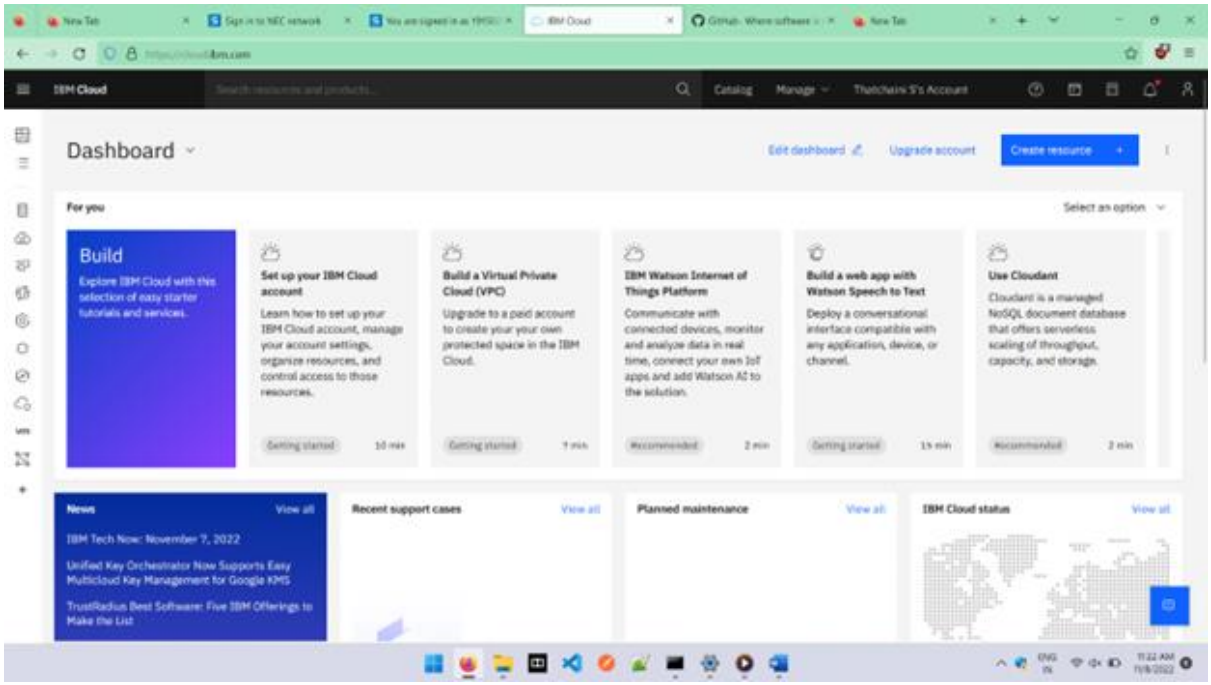


SETITNG UP APPLICATION ENVIRONMENT

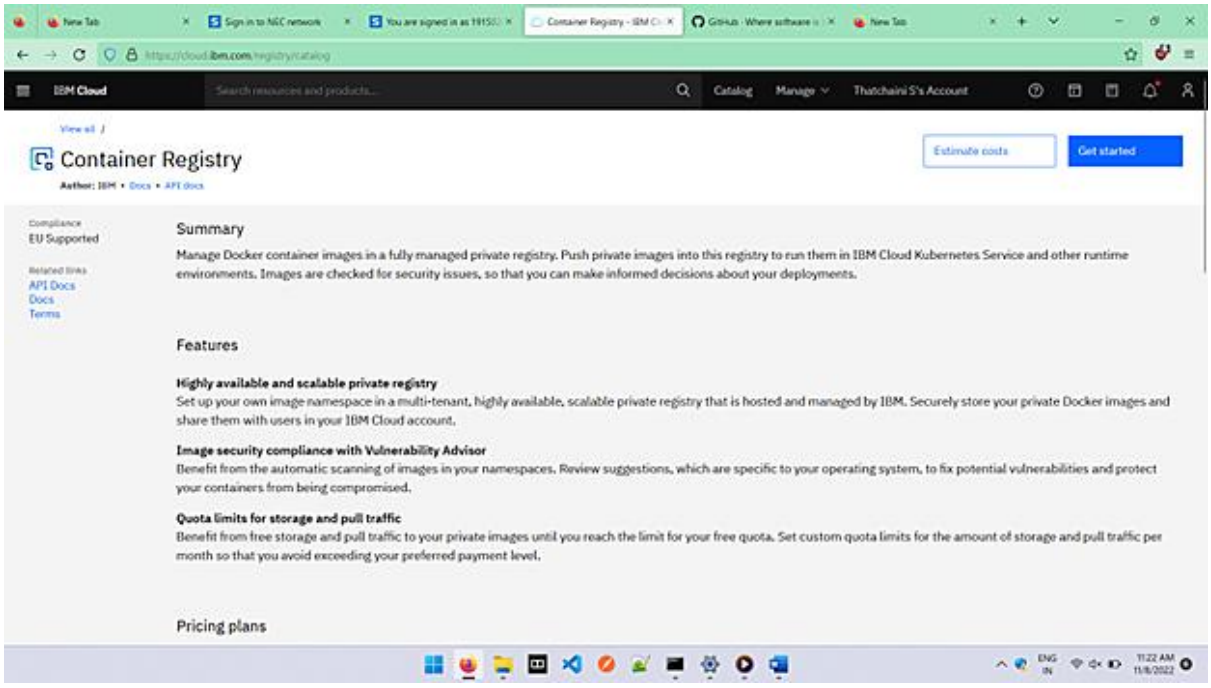
Install IBM Cloud CLI

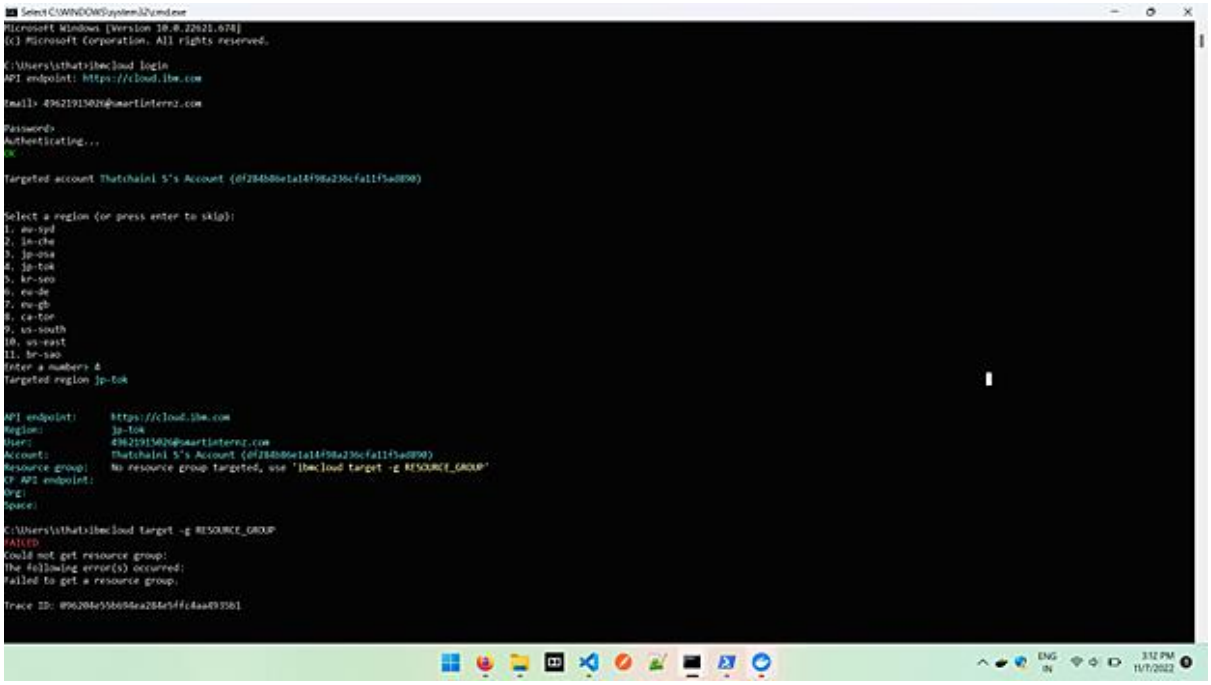
Date	04 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

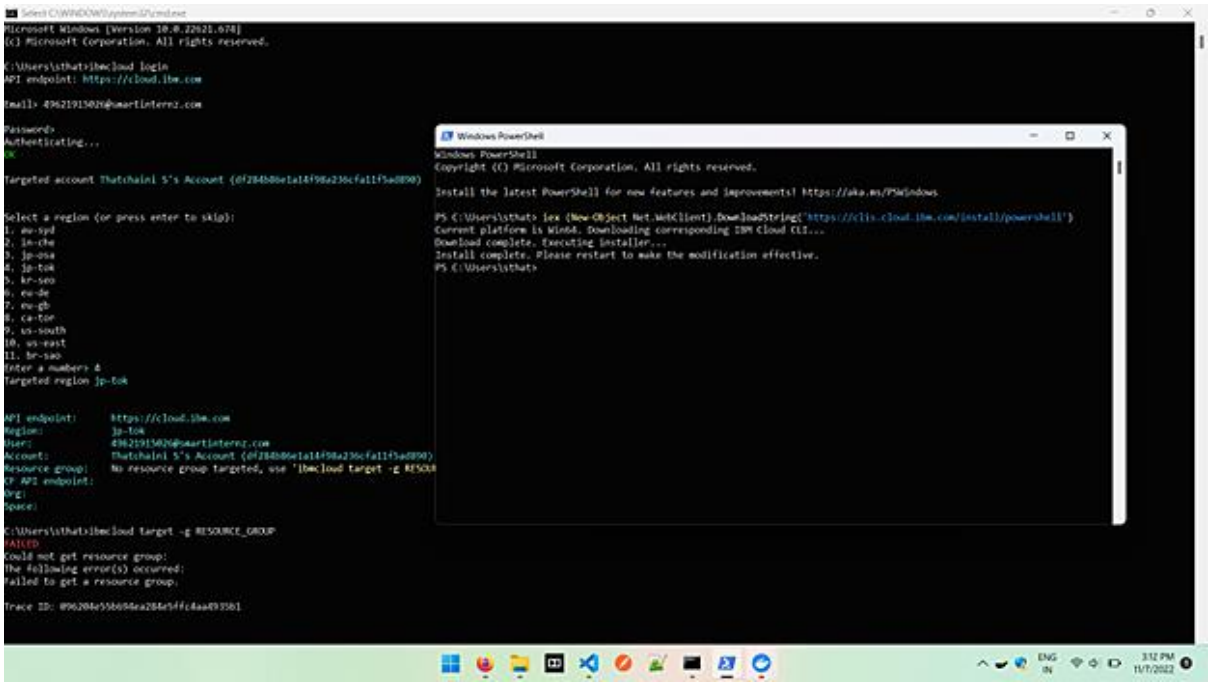
Step 1: Navigate to cloud.ibm.com

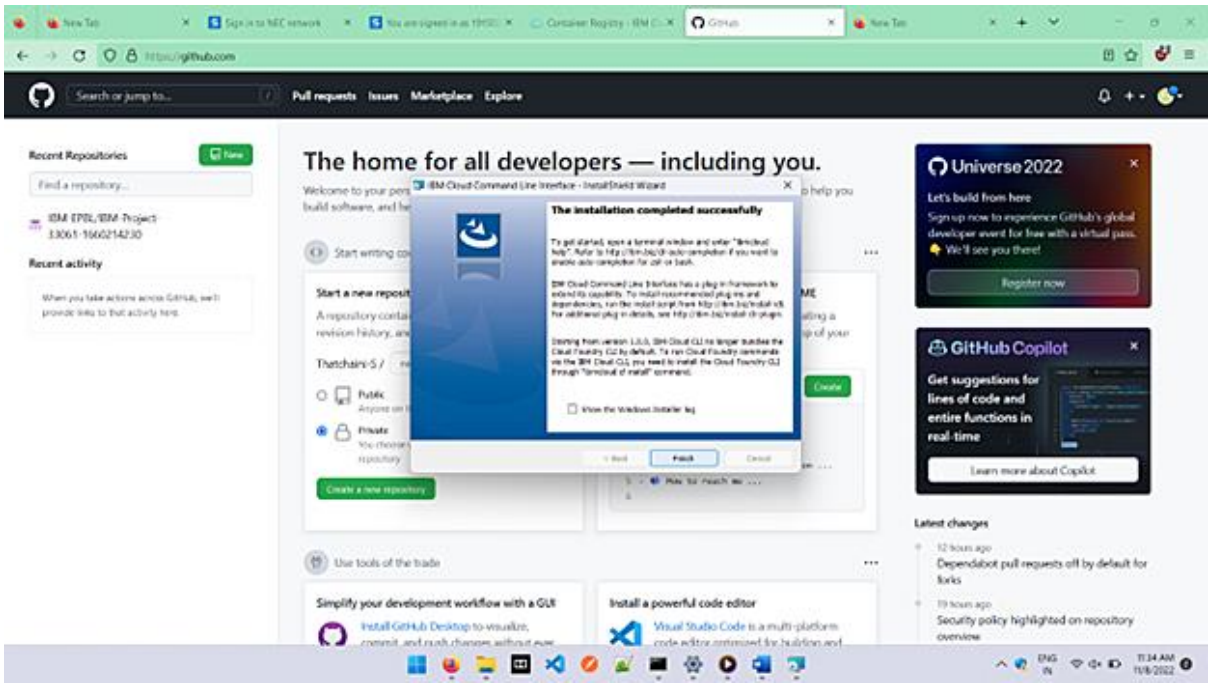


Step 2: Search on Container registry and give get started and follow the steps to install IBM Cloud CLI









SETITNG UP APPLICATION ENVIRONMENT

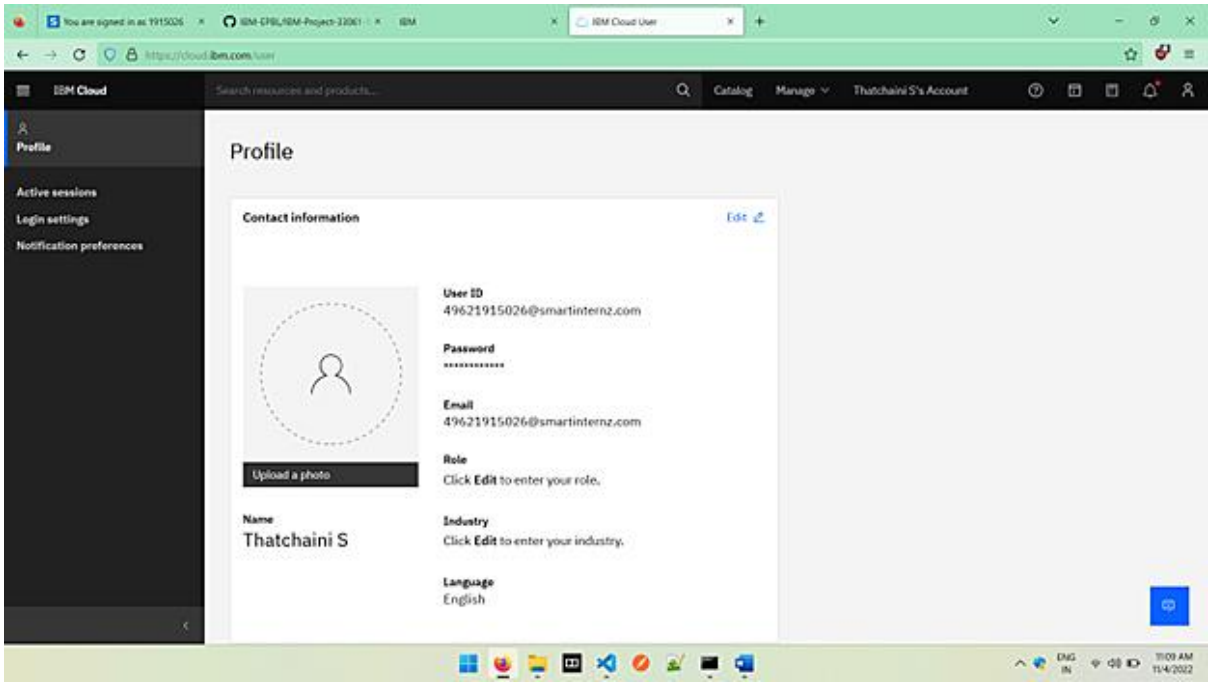
CREATE IBM Cloud Account

Date	04 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Step 1: Go to the official website http://cloud.ibm.com/

Step 2: Sign up using your credentials

IBM Cloud Profile:

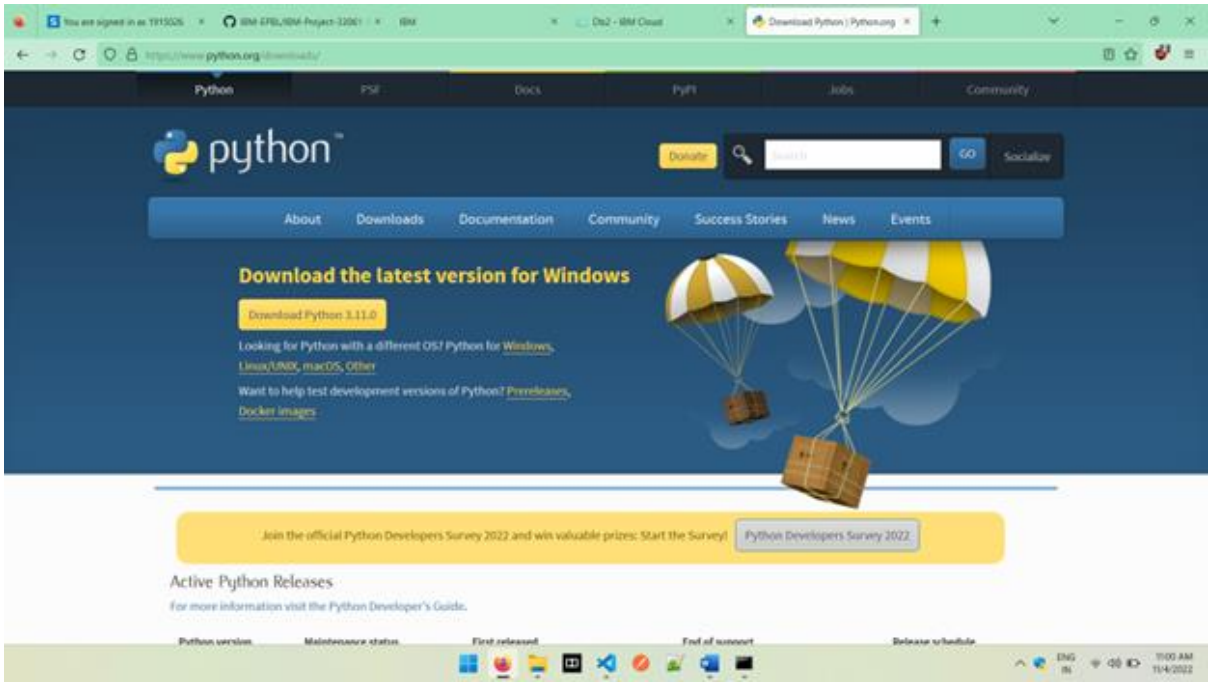


SETITNG UP APPLICATION ENVIRONMENT

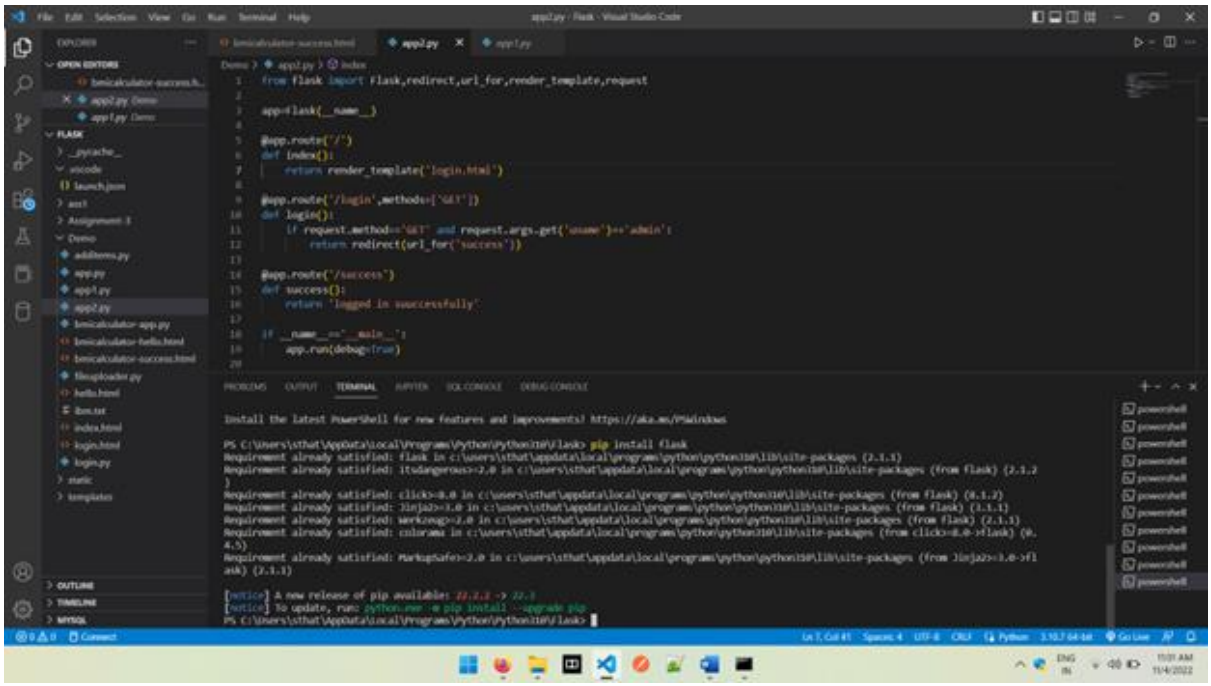
CREATE FLASK PROJECT

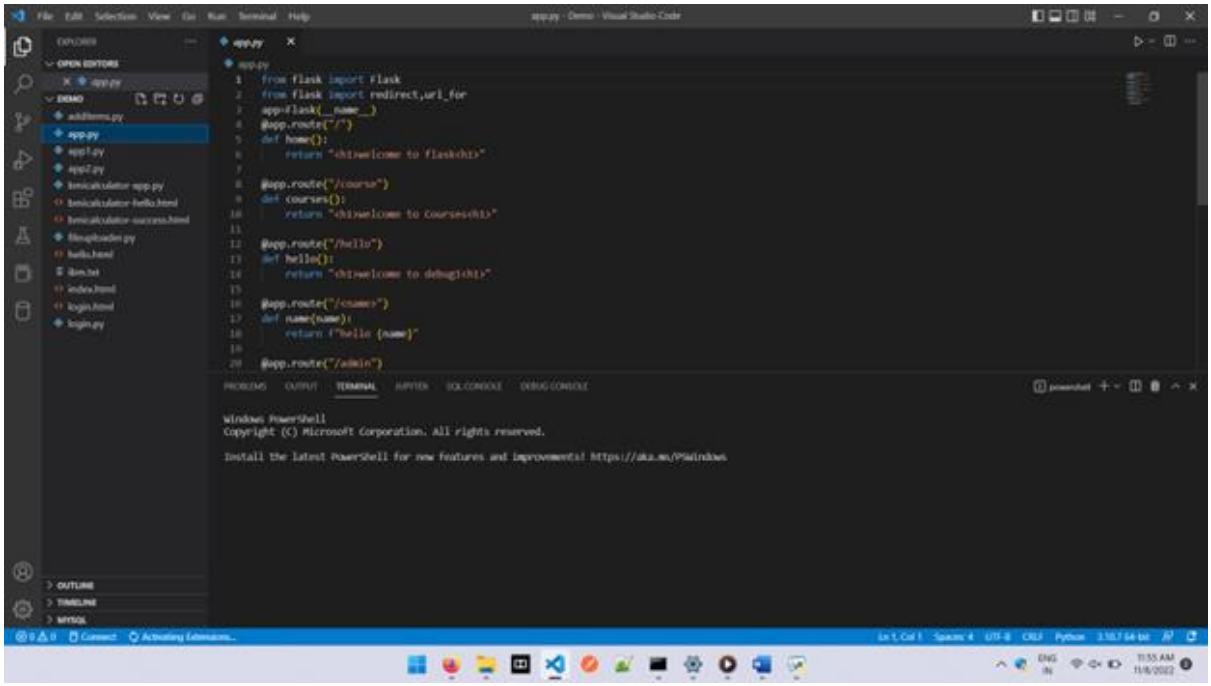
Date	04 November 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Step 1: Install Python latest version from python.org



Step 2: Install flask using the command pip install flask





Project Planning PhaseSprint DeliveryPlan

Date	30 October 2022

Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Product Backlog,Sprint Schedule, and Estimation (4 Marks)

Use the below template to createproduct backlog and sprint schedule.

Sprint	**Functional Requirements (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
S-1	User Panel	USN-1	The user will access the website and view theproductsit provides after registering in.	20	High	Thatchaini S Muthulakshmi A Venkatraman S Pradeep Rajaduraj W
S-2	Admin panel	USN-2	The administrator's task is tolook over the stock databaseandmonitor on everything that people are buying.	20	High	Thatchaini S Muthulakshmi A Venkatraman S

						Pradeep Rajadurai W
S-3	Chat Bot	USN-3	The user can directly talk to Chatbot regarding the products. Get the recommendations based on information provided by the user.	20	High	Thatchaini S Muthulakshmi A Venkatraman S Pradeep Rajadurai W
S-4	final delivery	USN-4	Container of applications using docker kubernetes and deployment the application. Create the documentation and final submit the application	20	High	Thatchaini S Muthulakshmi A Venkatraman S Pradeep Rajadurai W

Project Tracker, Velocity& Burndown Chart:(4 Marks)

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End-Date(Planned)	Story Points Completed (as on planned date)	Sprint ReleaseDate(actual)
S-1	20	6 Days	24 Oct2022	29 Oct 2022		29 Oct2022
S-2	20	6 Days	31 Oct2022	05 Nov 2022		05 Nov 2022
S-3	20	6 Days	07 Nov 2022	12 Nov 2022		12 Nov 2022
S-4	20	6 Days	14 Nov 2022	19 Nov 2022		19 Nov 2022

Velocity:

Imagine we have a 10-daysprint duration, and the velocityof the team is 20 (Points per sprint). Let's calculate the team's
average velocity (AV) per iterationunit (story points per day)

PROJECT PLANNING PHASE

PREPAREMILESTONE AND ACTI

VITY LIST

Date	30 October 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Remaining Task:

MILESTONES	ACTIVITY	DESCRIPTION
Project development ph ase	Delivery of Sprint-1,2, 3,4	To develop the code and submit the develop the cod eaftercompletion of testing
Implement ing webap plication	Create UI to interactwith the ap plication	Create UI • registration page • login page • view products page • add products page

	Create IBM DB2 and connect with thePython	Create an IBM DB2 inthe IBM cloud and connectit to Python.
Integrating send grid service	SendGrid integr ation with thePython	The SendGrid services must beinte grated in order for the application to send emails.
Developing a chat bot	Building a chat bot an dintegrate with The application	Build the chat botand integrate it to the flaskap plication
Deployment of app in IBMcloud	Containerize theapp	Create a docker imageof theapp lication in addition to push it to the IBM containerreg istry
	Upload imageto IB Mcontainer registry	Upload the image to IBMcontainer registry
	Deploy in inKubernetes cluste r	Once the image is uploadedto IBM container registry deploy the image toward IBM kubernetes clus ter

Completed Tasks:

MILESTONES	ACTIVITY	DESCRIPTION
Ideation phase	Literature survey	Literature surveyon theselected proj ect and informationgathering

	Empathy map	Prepare empathy mapto capture the user painand gains, prepare a list of problem statement
	Ideation	Organizing the brainstorming sessionand prioritize the top threeideas based on feasibility
Project designphase 1	Proposed solution	Prepare proposed solution document which includes novelty,feasibility of ideas, business model,socialimpact, scalability of solution
	Problem solution fit	Prepare problemsolutionfit documents
	Solution architecture	Prepare solutionarchitecture document
Project designphase 2	Customer journey map	Prepare customer journey map to understand the userinteractions and experience with theapplication
	Functional requirements	Prepare functional andnon-functional necessity document
	Data flow diagram	Prepare dataflowdiagram and userstories
	Technology architecture	Draw technology architecture diagram

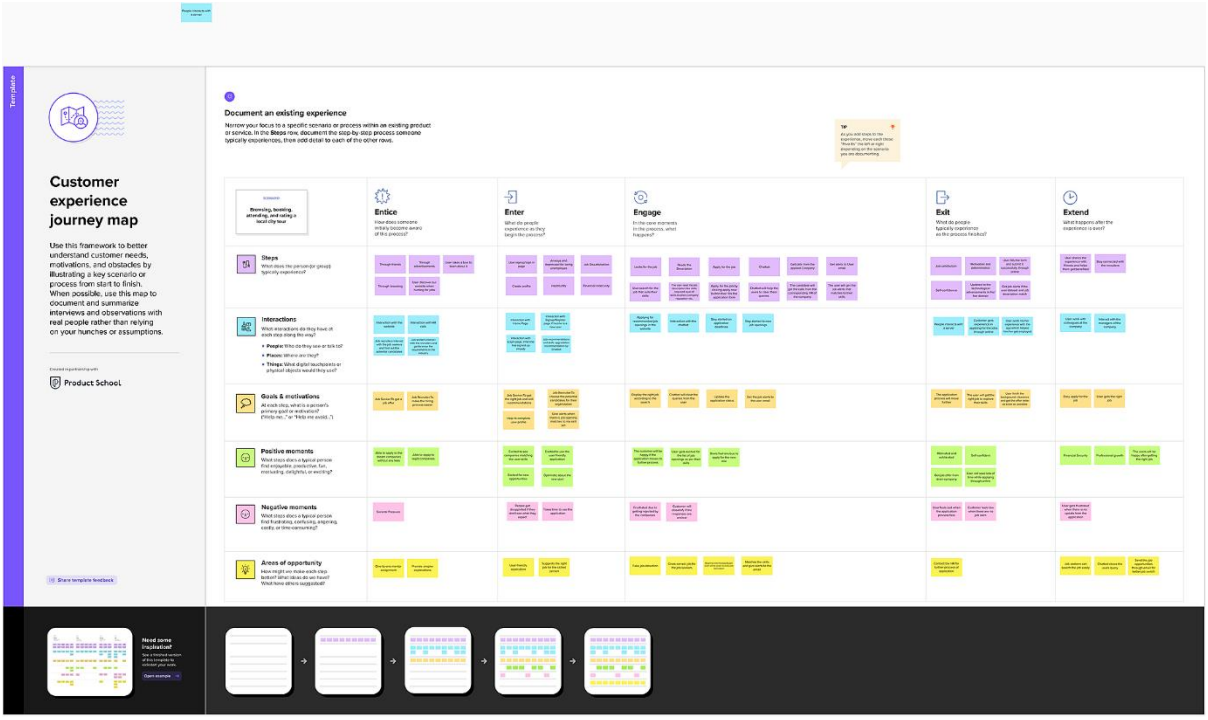
	Sprint delivery plan	Prepare springdelivery plan

Setting-up appenvironment	Create IBM cloud account	Sign up IBM cloudaccount
	Create flask project	Getting started with theflask to create project
	Install IBM cloud cli	Install IBMcommandline interface (CLI)
	Docker CLI installation	Installing dockerCLI

Project Design Phase-II

Customer Journey Map

Date	21 October 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks



Project Design Phase-II

Technology Stack (Architecture & Stack)

Date	20 October 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Technology Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table2

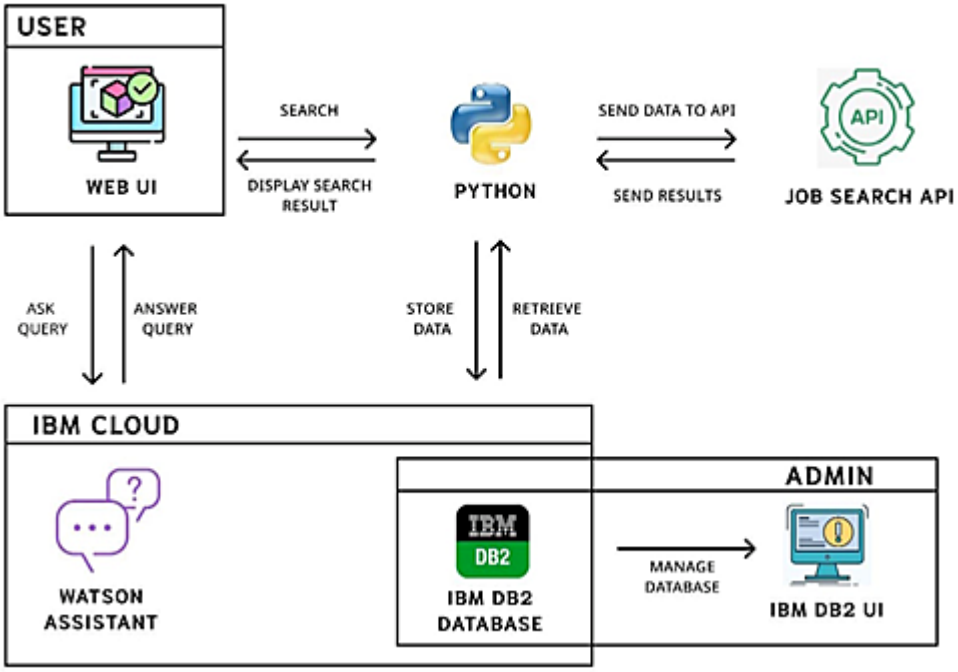


Table-1: Components & Technologies:

S.No	Component	Description	Technology
1.	User Interface	How userinteracts with application e.g.,Web UI, Mobile App,Chat bot etc.	HTML, CSS, JavaScript, Bootstrap
2.	Application Logic-1	Logic for a process in the application	Python
3.	Application Logic-2	Logic for a process in the application	IBM WatsonSTT service

4.	Application Logic-3	Logic for a process in the application	IBM WatsonAssistant
5.	Database	Data Type,Configurations etc.	MySQL
6.	Cloud Database	Database Serviceon Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other StorageService or Local Filesystem
8.	Infrastructure (Server / Cloud)	Application Deployment on Local System/ CloudLocalServer Configuration: Cloud ServerConfiguration:	Local, CloudFoundry, Kubernetes, etc.

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	IBM cloud Kubernetes service
2.	Security Implementations	List allthe security / access controls implemented, use of firewalls etc.	e.g., SHA-256, Encryptions, IAMControls, OWASP etc.
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier,Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g.,use ofloadbalancers, distributed servers etc.)	Technology used

5.	Performance	Design consideration for the performance of theapplication (numberof requests per sec, use of Cache, use of CDN's)etc.	Technology used

Project Design Phase-II

Data Flow Diagram & User Stories

Date	12 October 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Data Flow Diagrams:

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.

Example:

User Stories

User Type	Functional Requirement	User StoryNumber	User Story/ Task	Acceptance criteria	Priority	Release

	(Epic)					
Customer (Mobileuser)	Registration	USN-1	As a user,I can register for the application byentering my email, password, and confirming my password.	I can access my account /dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation emailonceI have registered for the application	I can receive confirmationemail& click confirm	High	Sprint-1
		USN-3	As a user, I can register for the applicationthrough LinkedIn	I canregister & accessthe dashboard with Linkedin Login	Low	Sprint-2
		USN-4	As a user, I can register for the applicationthrough Gmail	I can register and access the dashboard through Gmailalso	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application byentering email& password	I can log on to the application through emailidan	High	Sprint-1

				d password		
	Dashboard	USN-6	As a user, I can login and chat with thechatbot	Once I logged on the application I can chat withthechatbot	High	Sprint-3
Customer (Webuser)	Registration	USN-7	As a user, I can log on and register the application for the services being provided	I can access my account /dashboard	High	Sprint-1
		USN-8	As a user, I will receive confirmation emailonceI have registered for the application	I can receive confirmationemail& click confirm	High	Sprint-1
	Login	USN-9	As a user, I can log into the application byentering email& password	I can log on to the application through emailidand password	High	Sprint-1

Customer careexecutive	Should Regularize the Send grid service	USN-10	As a executive and service operator of the service they should make sure that service provided are properly send and received by the user.		High	Sprint-2
	Should monitor the chatbot regularly whether working or not	USN-11	As a executive to provide a quality based service chatbot is important for assisting if anyassistance is needed for the user		High	Sprint-2

Project Design Phase-II

Solution Requirements (Functional & Non-functional)

Date	13 October 2022
Team ID	PNT2022TMID20598
Project Name	Skill / Job Recommender-Cloud Application Development
Maximum Marks	4 Marks

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	1. Registration through Form 2. Registration through Gmail 3. Registration through LinkedIN
FR-2	User Confirmation	1. Confirmation via Email 2. Confirmation via OTP
FR-3	Job profile display	Display job profiles based on availability, location, skills
FR-4	Chatbot	A chat on the webpage to solve user queries and issue
FR-5	Job registration	Copy of the company the user applied for with its registration/description details will be sent to the registered email id.
FR-6	Logout	

Non-functional Requirements:

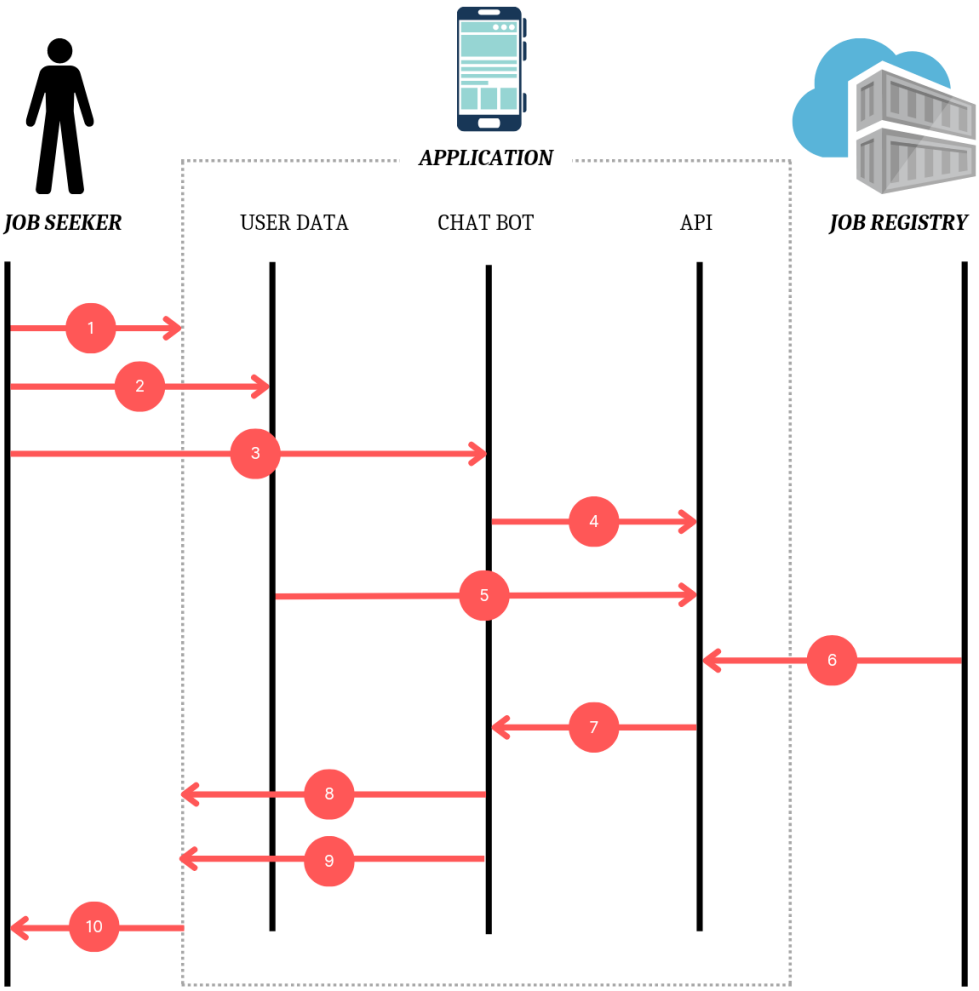
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	1. The webpage will be designed in such a way that any non-technical user can easily navigate through it and complete the job registration work. (Easy and Simple design.) 2. Reduce information overload by generating personalized job suggestions.
NFR-2	**Security**	1. Using of SSL certificate (Python Flask to Cloud connect) will provide security to the project. 2. Database will be safely stored in DB2.
NFR-3	**Reliability**	To make sure the webpage doesn't go down due to network traffic.
NFR-4	**Performance**	1. Focus on loading the webpage as quickly as possible irrespective of the number of user/integrator traffic. 2. Carry out an evaluation to quantify empirically the recommendation abilities of two state-of-the-art methods, considering different configurations, within the proposed framework

NFR-5	**Availability**	1. The scraper is set up to avoid duplicate job offers, thus all the job offers are unique. 2. To making the user reliable. This webpage will be available to all users (network connectivity is necessary) at any given point of time. 3. Made publicly available a new dataset formed by a set of job seekers profiles and a set of job vacancies collected from different job search engine sites.
NFR-6	**Scalability**	1. Increasing the storage space of database can increase the number of users. 2. Add some features in future to make the webpage unique and attractive

Solution Architecture

Title: Skill/Job Recommender
Technology: Cloud Application Development
Team ID: PNT2022TMID20598



1. Create user profile
2. Stores user data
3. Make chat request using assistant
4. Search jobs based on user details
5. Fetch jobs based on user skills
6. Search job openings
7. Post job openings
8. Display job openings
9. Filter appropriate Job profile
10. Notify results

Project Design Phase-I

Proposed Solution

Date	24 September 2022
Team ID	PNT2022TMID20598
Project Name	Project – Skill and Job Recommender Application
Maximum Marks	2 Marks

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

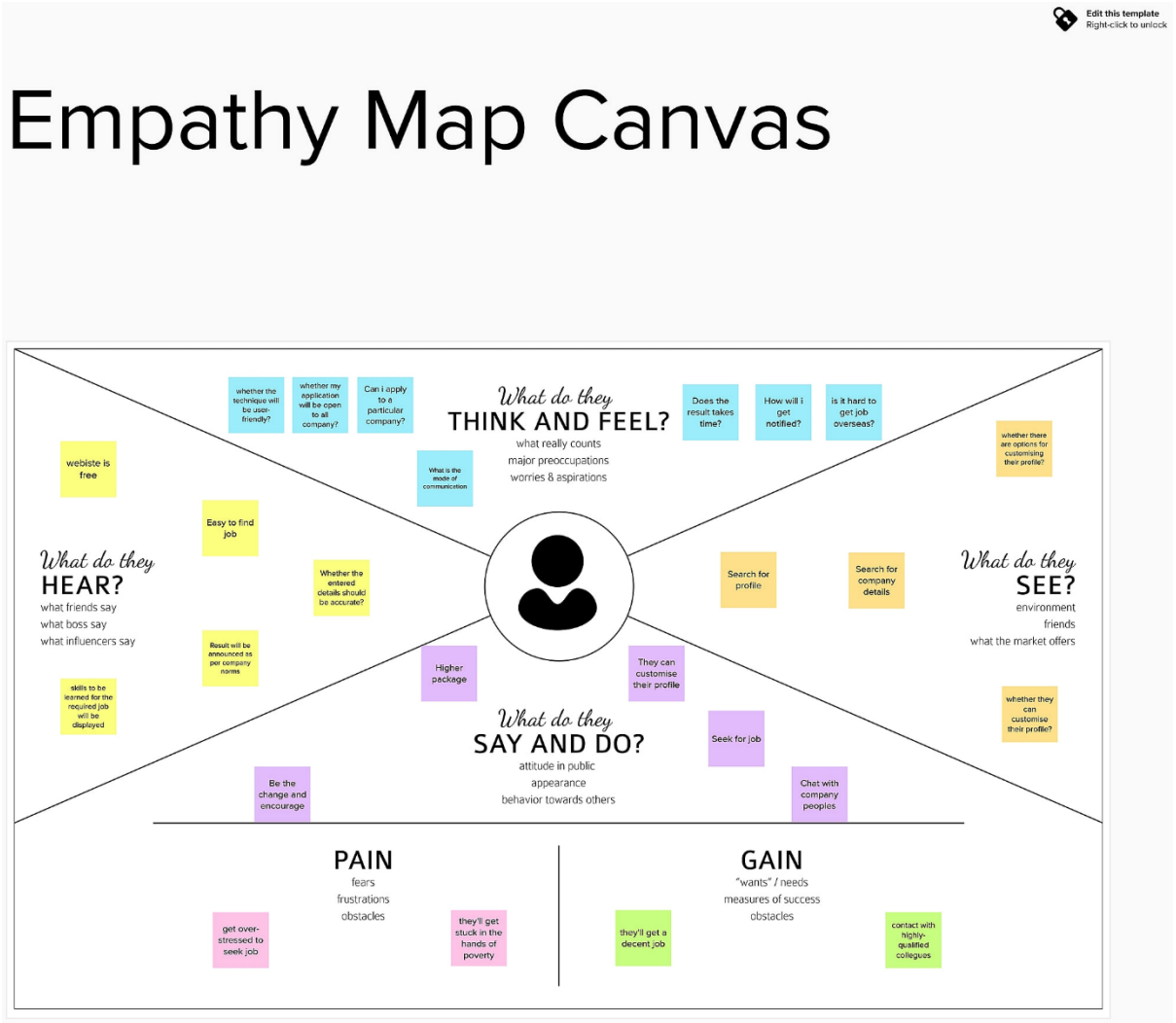
S.No.	Parameter	Description

1.	Problem Statement (Problems to be solve)	1. Having better skills but wondering which job will best suits you? 2. We are givingopportunity to job Seekers. 3. User can access large no of data. 4. Having lots of skills but wondering which job will best suit you? Don't need to worry! We have come up with a skill recommender solution through which the fresher or the skilled person can log in and find the jobs by using the search option or they can directly interact with the chatbot and get their dream. 5. To develop an end-to-end web application capable of displaying the current job openings based on the user skillset. The user and their information are stored in the Database. An alert is sent when there is an opening based on the user skillset. Users will interact with the chatbot and can get the recommendations based on their skills. We can use a job search API to get the current job openings in the market which will fetch the data directly from the webpage.

2.	Idea/ Solution description	1. To focuses on fit for feature. 2. To provide user what company expect. 3. Made publicly available a new dataset formed by a set of job seekers profiles and a set of job vacancies collected from different job search engine sites. 4. Put forward the proposal of a framework for job recommendation based on professional skills of job seekers. 5. Carried out an evaluation to quantify empirically the recommendation abilities of two state of the art methods, considering different configurations, within the proposed framework. 6. We thus present a general panorama of job recommendation task aiming to facilitate research and real-world application design regarding this important issue.

3.	Novelty / Uniqueness	1. We provide high Data Security. 2. We provide Mobile and computer both platforms. 3. The best position is suggested to any person according to her skills. While the position of known profiles is assumed to be correct, it should be noted that there are usually multiple advisable positions corresponding to a set of skills. A recommendation system should return a set of most likely positions and all of them can be equally valid. 4. The recommendation method we use is simply based on representing both positions and profiles as comparable vectors and seeking for each profile the positions with the most similar vectors.
4.	Social Impact / Customer Satisfaction	1. At last, we believe that two people with equal talent should have equal access to opportunity and we're committed to making this vision reality through our project. 2. We are providing Friendly approach and employability. 3. Students will be benefited as they will get to know which job suits them based on their skills.

5.	Business Model (Revenue Model)	1. We are connecting you with other professionals also with companies and recruiters. Along with professionals, it also serves companies and even charges for providing certain premium services. 2. We can provide the application for job seekers in a subscription based and we can share the profiles with companies and generate the revenue by providing them best profiles
6.	Scalability of the Solution	1. Scalability is a custom training and organizational development firm dedicated to helping businesses scale. 2. Data can be scaled up and scaled down according to number of current job openings.



Skill Job Recommender

Literature Survey

a. **Introduction**

The recommender system is becoming part of every business. The business tries to increase its revenue by raising the user's interaction by recommending new items based onuser preferences. We have witnessed the rise of Netflix in the entertainment domain, usingtheir strategies to implement a recommender systeminto their existingecosystem. But therehas been a minimal study in the hiring field from the perspective of a job seeker. To start
any research, it is quintessential to review relevantwork in the domain and technology.

1.2 Recommender Systems

As discussed previously, RecSys are the system that analyses user preference history and catersthem with differentoptions of servicesrelated to the requirement. Recom mendersystems emerged as an independent research area in the mid-1990s(Ricci *et al.*, 2011). In recent years, the interest in recommender systems has dramatically increased. In the Rec- ommendation algorithm, it classifies into four types: Content-based filtering, Collaborativefiltering, Rule-based, and Hybrid approaches (Mobasher, 2007; Al-Otaibi_and_Ykhlef, 2012).

Collaborative Filtering (CF): Collaborative Filtering is a technique is based on the human ratings that are given to an item by a user and find similarity between different users who
have given similar ratings to an items(Hu_and_Pu, 2011). The essential operation used here is thememory-
based nearest neighbor approachto group users who have a similarinterest. As thevolume of data grows gradually, there will be high latency in generating recommendationsMobasher (2007); Herlocker *et al.* (1999). Collaborative filtering has an advantage over content-based filtering techniques, but due to the nature of the hiring process, a job cannot berated by the user and will not be possibleto create a similarity matrix.

Content-based filtering (CBF): These are the most subjective and descriptive based filtering. Content-based filtering can also be called as attribute-based recommender as it uses the explicitly defined property of an item. It is an approach to an information

retrieval or machine learning problem. The assumption made in content-based filtering is that user prefersitem with similar properties. Content-based filtering recommends items to the user whose properties are similar to the item which the user has previously shown interest. Mobasher (2007) express that drawback of this filtering technique is their tendency to over-specialize in suggesting the item to a user profile as user profiles are relayed on an attribute of the previous item opted by the user. Nevertheless, in the job domain, the job listed in the job board be availableonly for few days; due to the nature of the domain,the tendency to over-specializein recommending the same item would not be any problem in the job domain rec ommendersystem. In domains like entertainment, user preference are tends to change depending on various factors, but In Job domain, the user tends to look for the job where he can use his previous skills. New recommendation of jobs can be made when there is a change in user preference, i.e. if a user thinks to change his/her job domain by updating his new skills andthe job domain if he/she wishes. Another scenario of new recommendation is when new jobs are listed in the database;system would identifythe properties of the job listed, suc h as job domain and skills requiredfor the job and matcheswith the users with a high similaritys core.

Rule-based Filtering (RBF): These filtering techniques depend upon decision rules suchas an aut omaticor manual decisionrule that are manipulated to obtain a recommendation forthe user profile. Currently,the E-commerce industryuses a rule-based filtering technique torecommend an item based on the demographic regionof a user, purchase history,and otherattributes that can be used to profile an user. A drawback in rule-based filtering is user feedsthe information to the system. These inputs are utilized as a

description of a user profile orcan be considered as a preference of a user, defined by the user. Thus the data acquired is prone to bias. With the age of the user's profile, recommendation tends to hit the saturati onand become staticMobasher (2007).

Hybrid filtering (HF): As the title describe, its incorporation of multiple techniques to improve the performance of recommendation. The previously discussed recommendation technique has its weakness and strengths. In order to get a better recommendation and overcome the challenges posed by earlier techniques, this technique is sought after. All of the learning/model-based techniques suffer from cold-start in one or other form. It is a problemrelated to handling a new user or new item. These and other shortcomings of the CF,CBF, and RBF could be resolved by using hybrid filtering techniques Burke (2007); Jain and Kakkar(2019); Dhameliya and Desai (2019).

The surveys conducted by Burke (2002) and Dhameliya and Desai (2019) have identified different types of hybridfiltering techniques that could be used by integrating CF, CBF, andRBF.

i. Weighted: The similarity score obtained from different recommendati on componentsare couplednumerically to get one betterrecommendati on.

ii. Mixed: Recommendations obtained from different recommending tec hniques are puttogether and presented as one recommendation.

iii. Switching: choosing one among the recommendation components based on the scenar- ioswhere it suitsbest.

iv. Feature Combination: Attributes derived from diverse knowledge origins are fused and supplied to a recommendation algorithm.

v. Feature Augmentation: One recommendation technique is used to compute a set of attributes of user or item, which is then part of the input to the next recommenda- tion technique. Two or more recommendation techniques are serialised to get on recommendation.

vi. Cascade: Recommending systems are given strict priority, with the lower priority ones breaking ties in the scoring of the higher ones. Here one Recsys technique refines recommendation of another.

There had been attempts to develop a recommendation system by several researchers. One such implementation was done by Rafter *et al.* (2000). They had devised a hybrid Recsys CASPER for Job finding search engine. They had implemented an automated collaborativefiltering module and personalized case retrieval modulein their job recommend ation system.ACF module utilized user behavior information such as read time and activity on the page during his time on the system to profile the user. Similarity measure such as the Jaccard index and other clustering algorithms was used for similar groupinguser against tar getuser.Their other module PCR finds the similarity betweenthe user's query and jobs in the system.The module computes similarity with a target user's query and jobs from the job case
base using different similarity measures. This systemhas faced sparsityand scalability probl ems.

a. **Natural languageprocessing**

These are the times that can be considered as an era of data. Every keystroke hit on twitter,online news, or in a research paperis recorded somewhere on the internet. All the segenerated data are availablefor the analysis through many means. In this abundanceof dat a,Text data holds the majority of the share. Most of these text data are in an unstructured form. To put the abundance of text data into a perspective, a trillion-plus query per year is being handled by Google, and Whatsapp handles 30+ billion messages per day. That beingsaid, how do we extract information from the unstructured text data or how can we make machine understand what the text is about? To answer all the questions, Text analysis is a most sought after technique to extract useful information from the text data. Text analysis can be performed by utilizing techniques such as Natural language processing. Natural languageprocessing is a process of information retrieval from unstructu red data. It referstothe utilization of computers to process natural language(Brants, 2003). The advancement in the personal assistant, text summarizing, and methods to caption a subject is due to the successful research in the field of NLP. Search engines like

google and other industry leaders utilize NLP to its full extent. The gap between industry and academia in the field of NLP isvery minimal as there is an advancement in the NLP; the business has tried implementing and has broughtcloser to everyone's life.

In Recsys for the hiring domain, the data we handle here is nothing other than text data.A user profile describes the details about user experience and skills he/she familiar with. On the other hand, the job listed has information as job title, skills required to fulfill the role. All these information is filled with text data. In this scenario, we utilize the Natural Language Processing to measure the similarity between Jobs by checking the similarity between the job title and job description of the listed job. Determining the text -similarity is an essential task in several industrial application such as query search, text summarizing and video tagging(Kenter_and_De_Rijke, 2015). In earlierstudies, researcher s have used

different approaches to identify similarity between the text by using edit distancealgorithm which is discussed by Mihalcea *et al.* (2006), lexical overlapping technique (Jijkoun *et al.*, 2005) as this might work in most cases but can't rely on these technique because of its frail nature(Kenter and De Rijke, 2015). In such cases, we rely on technique called word embedding. This is huge development in the field of distributional semantics. As this requires only a large amountof unlabelled word data. These words are represented in seman tic spaceas a vector. That is, words that are semantically similar will stay close in the semantic space.In order to retrieve terms that based on the similarity between two terms, we can utilize most well know method called word2vec a vector space model then we can use cosine similarityto measure the similarity between them (Shrestha, 2011; Barrón-Cedeno *et al.*, 2009).
Thismodel can also be used to determine similarity between the sentences(Barzilay_and_Elh adad,2003). It's a group related model which is used to produce word embedding and these are set of languagemodelling and featurelearning techniques of NLP where words are mapp edto real values in the vector. Typically word2vec takes large set of words which is called corpus as a input and producesvector space with dimensions being in hundreds(Mi kolov*et al.*, 2013). Once vector space model is generated we can use similarity measuringm ethodto determine the distance or how similar is the word with which we are comparing. To

findsimilarity in vector spacewe can use similarity measureslike Cosine similarity and Jacc ardsimilarity.

i. **Jaccard Coefficient**: Jaccard Coefficient is a methodto compare elem entsof two setsto identify which elements are shared between two sets and which are distinct. It's similarity measure for two sets of data with result ranging from 0% to 100%. Two sets can be said similar, when result is close to 100% . Formula for Jaccard Index is as shown below(Sternitzke_and_Bergmann, 2009),

i. **Cosine similarity**: Cosine similarity is also a measure to find similarity between twosets of non zero vector. It is a weighted vector space model utilized in the process of information retrieval. The similarity is measured by using euclidean cosine rule,i.e., by taking inner product space of two nonzero vector that measures the cosine of the anglebetween the two vectors. If the angle between two vectors is 0 deg , then the cosine of 0 is 1; Meaning that the two non zero vectors are similar to each other.In order to weight the words we have used the well-known word2vec vector space model(Rong,2014; Herremans_and_Chuan,2017).

2.2 Inferences

Based on all the researchmethodologies and techniques reviewed in this chapter, the CF technique cannot be considered as it does not satisfythe aims of the research. As the dataset of the user does not hold the information of rating againsta particular job, we will not be ableto create a rating matrix that requires for CF technique. Instead, I have chosen to imple mentcontent-
based filtering. I used multiple attributes in the user data to create a user profileandrecomm end the job to those profileswhich have a high similarity score received from cosinesimilarit y. Also, i have given higherweights to job skills when compared to the job domainof the us er while computing similarity scores between user profile and job.