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Decoding Job Candidates: Forecasting Personas using Resume/ CV Analysis.

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Abstract: *The persona of an individual strikes out as a very crucial part of the development and growth of an organization as well as one's individual growth. Out of many, one of the stereotypical strategies of speculating an individual's personality is either by the usual general inspection or by inspecting an individual's Curriculum Vitae. The traditional method for the recruitment procedure of a candidate is a non-automatic (manual) pre-selection of the individual's resume trying to seek a job with respect to the prerequisite specified by the organization. With this work, the goal primarily is to design a system that carries out the operation of separating candidates based on eligibility criteria and persona estimation in a recruitment process automatically. Hence, to satisfy the requirements of the work proposed above, a webpage that operates online is advanced for the enrolment of candidates' information and investigation of an individual's personality via a persona questionnaire in the form of an online multiple choice questions test. With respect to all of this, the proposed system then inspects proficient aptness by analyzing the datasets that are trained on the CV/Resumes uploaded by the applicants. The indicated work incorporates two machine learning algorithms which are "Logistic Regression" and "Random Forest Classifier" which fairly help to select a candidate for the recruitment procedure. Consequently, the outcomes of the persona questionnaires are to be sent to the candidate as well as the governor of the indicated system respectively.*

Keywords: Automatic recruitment procedure, Persona questionnaires, OCEAN, Machine Learning, Persona investigation, Random Forest Classifier.

I. INTRODUCTION

Personality can be an important factor for potential employers when they are considering your job application. Although technical skills and experience are essential, employers are often, looking for employees who fit well with the company culture and can work effectively with others. Therefore, including some information about your cv/resume can be beneficial. However, it's important to note that it's not overdone and makes your personality the main focus of your cv/resume. Instead, you should highlight a few key traits that are relevant to the job that one is applying for. For example, if one is applying for a service role, you might want to emphasize your communication skills, empathy, and ability to work well under pressure. You can showcase your personality in a few different ways on your cv/resume such as through your personal statement or by highlighting one's hobbies and personal interests. By doing so one can increase their chances of standing out from other candidates and finally landing the job that one wants to have.

The indicated study inspects as well as segregates the personas from a certain group of individuals incorporating machine learning algorithms i.e. Logistic Regression and Random Forest Classifier. Mostly every automatic-recruitment system completely and broadly browses and examines the Curriculum Vitae (CV)/ Resumes that are attached by the candidates and filters the applicants through various processes necessary to inspect the applicant's knowledge(practical and theoretical) in the domains such as the technological and soft skills completely, whereas the proposed work incorporates a bunch of persona questionnaires, targeting the applicant's persona as well as selecting that particular individual established on that individuals capabilities, controlling and managing abilities. Likewise, the indicated system predicts the current users' and recent users' persona through the personality data that is stored through grouping from the user data of the former applicants. A Logistic Regression model was used to predict output class labels for dependent grouped data in the test dataset. Additionally, a Random Forest classifier was employed to classify the

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datasets into specific categories in order to forecast a candidate's persona and shortlist them based on their capacity to make significant, confident choices.

II. LITERATURE SURVEY

In the paper "Personality Prediction Through CV Analysis using Machine Learning Algorithms for Automated E-Recruitment Process", the authors G. Sudha, Sasipriya K K, Sri Janani S, Nivethitha D, Saranya S, Karthick Thyagesh G, proposes to using machine learning algorithms to assess a CV and forecast personality traits like openness, conscientiousness, extraversion, agreeableness, and neuroticism in job applicants. In order to extract pertinent information from the resume, the system employs natural language processing techniques. After that, machine learning models are used to forecast personality traits. According to the study, the proposed system may automate the e-recruitment process and predict personality traits with a high degree of accuracy. In addition to reducing human bias in the selection process, the authors contend that their system can assist firms to save time and dollars throughout the recruitment process.

In the paper" A Machine Learning Approach for Screening Individual's Job Profile Using Convolutional Neural Network", the authors are M.F. Mridha, Rabeya Basri, Muhammad Mostafa Monowar, Md. Abdul Hamid. The present information technology craze, particularly in Artificial Intelligence, centers on the pursuit of human things through machines (AI). By extending its branches to many dimensions and levels, machine learning has become popular as a component of AI. One of the newest technologies, deep learning, is used in sectors that involve huge amounts of processing. In the field of NLP, several tools and technologies have been developed and dissipated for their relative benefits and drawbacks. The job profiles of candidates can be screened by reviewing their CVs and resume for selection using the most sophisticated and intellectual procedure in accordance with HR requirements. One by one, each profile is read, and it is noted whether or not it has been chosen for the preliminary stage. This work aims to automate this screening process through a thorough analysis of NLP to revolutionize the entire recruitment process by making employer tasks easier than ever before. This work is also capable of ranking the CVs of the individuals by matching the total fields in the CVs with the required fields. Also, compared to other methods, our classification model exceeds them with an accuracy of 74% for the BDJOBS site in terms of precision, recall, and f1-score.

The paper "Candidate Selection for the Interview using GitHub Profile and User Analysis for the Position of Software Engineer" is published by authors R.G.U.S.Gajanayake, M.H.M.Hira, P.I.N.Gunathunga, E.G.Janith Supun, Anuradha Karunasenna, Pradeepa Bandara. Choosing the best applicants for interviews is a crucial step for businesses because it can impact their general productivity. The standard procedure for hiring new staff for a long time has been for recruiters to review Curriculum Vitae (CV), shortlist applicants, and then contact them for interviews. Pre-screening procedures are now used by companies to cut down on the time needed for the aforementioned process. Yet for those systems to evaluate the candidate, they require enough data. For instance, when hiring a software engineer, recruiters are considering candidates' programming skills, academic standing, and personality attributes. In this study, a pre-screening method is suggested for selecting candidates for the position of the software engineer. Candidates are selected using information from initial call transcripts, GitHub profiles, LinkedIn profiles, CVs, academic transcripts, and letters of recommendation. The Big Five personality traits, insights from the CV and GitHub, the candidate's skills, background, and capabilities from the recommendation letters, as well as programming skills and knowledge from the Academic transcript and Linked Profile are all identified using this approach, which extracts textual features of various dimensions based on Natural Language Processing. The findings from the various domains are displayed, demonstrating how the chosen supervised machine learning algorithms and methodologies may be utilized to assess the most qualified individuals.

The paper "Real-Time Resume Classification System Using LinkedIn Profile Descriptions" published by authors Mr. Ramraj S, Dr. V. Sivakumar, and Kaushik Ramnath G. For both job seekers and recruiters, precise job and resume categorization is essential in the world of online job recruitment. In order to train the model with texts, classify them into labels, and then compare the results. This study aims to have developed an automatic text classification system that makes use of a number of techniques, including Term frequency-inverse document frequency with machine learning and convolution neural networks. The applicants shall be divided into various categories using the resume data that has been provided. This employs domain adaptation because resume data is so delicate. A huge dataset of job description

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excerpts is used to train a classifier, which is subsequently used for the classification of resume data. Consistent classification performance is seen despite the limited dataset.

III. METHODOLOGY

The primary goals of this effort are to (i) identify the best candidate for a specific job description, (ii) facilitate the HR department in doing so, and (iii) assist the business to create a highly skilled workforce by taking into account not only skills and expertise but also meaningful personal traits thatare necessary for a particular job. The purpose of this projectis to make it easier for the HR department to choose the best applicant from a big pool of candidates for a specific job opening, creating a workforce of specialists for the firm. One's personality qualities may be utilized to evaluate their likelihood of succeeding in a profession or job. To put it in other words, employers or recruiters may be able to tell if a person would do well in a certain function or work just by looking at their personality. Characteristics including work engagement, emotional stability, openness to new experiences, and agreeableness are frequently taken into account in this context. Employers may be able to make better recruiting decisions and develop a stronger and more successful staff by utilizing personality as a predictor of jobperformance. Several scientific research demonstrates that personality is the most reliable indicator of job success andthat it is equally helpful for evaluating an applicant's behavioraltemper in various different situations, hence these further permit recruiters or employers to have an understanding ofwill the candidate do well in their employment journey ahead. Over the traditional approach of hiring, using a personality test as a tool can have a number of benefits. Here are a few ways it may benefit hiring managers. Personality assessments may shed light on a candidate's working methods, communication preferences, and other crucial characteristics that may affect how well they perform in their jobs. Conventional hiring practices are susceptible to prejudice because recruiters may unintentionally prefer applicants with similar backgrounds or experiences. On the other hand, personality tests are frequently standardized. Comparing personality tests to more conventional hiring practices, including performing several rounds of interviews, can save time and money. Early on in the hiring process, personality tests can assist recruiters in eliminating individuals who are not likely to be a good match for the position.

When a candidate is a good fit for the job and has the necessary skills and personality traits, they are more likelyto perform well in the role. This can lead to increased productivity. When employees are a good fit for their job, they are more likely to be satisfied with their work. This can lead to better engagement, increased motivation, and a greater sense of fulfillment in their job. Employee retention rates are higher when there is a strong fit between their position and the corporate culture. This can lower the priceof hiring new staff to replace departing ones for the company. Finding the best applicants can eventually result in greater job performance, more job satisfaction, better working relationships, lower recruiting expenses, and higher employee quality and retention. Hence the intended systemwill justify that Administering a personality test during the recruitment process can be a more effective approach to screening candidates and determining their suitability for a job. This method allows for the prediction of a candidate's job fit based on their personality traits, potentially resulting in a more accurate shortlisting process. The persona test thatthis system agrees to provide will necessarily be a multiple-choice question test which will have four options and the candidate appearing for the test must select one. Then the further procedure will be up once all the results are out.

IV. BIG 5 PERSONALITY TRAITS

The Big 5 Personality Individual differences in personality, conduct, and social interactions can be understood using traits. They are frequently used to forecast job performance,academic success, and other crucial life outcomes in a variety of sectors, including psychology, education, business, and human resources. It is also known as the Five-Factor Model (FFM). The Big 5 model was released by the end of 1950. Itconsists of five broad characteristics or dimensions that can be used to sum up someone's personality and they are as follows:

- Openness- Openness is a personality trait that describes howmuch a person enjoys thinking about complex and abstractideas. People who score high on openness are usually creative and like to try new things. Alternatively, individualsthat are low on openness are mostly who are more practical, andfocused on things they already know, that is they are not usually eager to learn new things and prefer conventional ways of doing things. They don't usually like to take risks ortry new things.

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- Conscientiousness- Conscientiousness is a personality traitthat refers to a person's ability to control themselves and their behavior in all situations in order to achieve their goals. People who score high in conscientiousness are ideally veryorganized. On the other hand, people who score low on conscientiousness are often impulsive and easily distracted.
- Extraversion / Introversion - Extraversion refers to how social a person is in his/her life and how soon can he/she build a conversation or gel up with people. Those who are extroverts, they actively participate with others and easily make friends. Unlikely introverts are the ones who are mostly a little shy and do not express much or talk much inasocial environment.
- Agreeableness – Agreeableness is a trait of one's personality that judges the individual in terms of how eager he/she is to prioritize helping someone else when in need over his/her own needs. People who have a high score in Agreeablenessare empathetic and often find fulfillment in caring for and helping others than prioritizing their own stuff. Unlikely, individuals with low scores of Agreeableness tend to have lessempathy and prioritize their own needs above those of others.
- Neuroticism- Neuroticism is a personality trait of an individual's approach toward discovering negative emotions. Although a lot of people face these emotions, some individuals might not be able to have control over them. HighNeuroticism scores indicate more chances of reacting to conditions with an emotional approach like fear, anger, andsadness, while the ones with low Neuroticism scores are more likely to take their setbacks in positively and move ahead in life.

The above-mentioned are 5 personality traits that are commonly abbreviated as "OCEAN".

V. ALGORITHMS

The Logistic Regression: - A supervised classification machine learning algorithm is the logistic regression algorithm. In aparticular classification problem, the target or the output variable, (y), can take only discrete values for a given set ofinputs (X). Logistic regression assumes that the relationshipbetween the predictor variables and the outcome variable is linear on the logit scale.

It is an appropriate regression analysis to conduct when the dependent variable is dichotomous (binary). Like all regression analyses, the logistic regression is a predictive analysis. Logistic regression is used to describe data and to explain the relationship between one dependent binary variable and one or more nominal, ordinal, interval, or ratio-level independent variables. Logistic regression is another powerful supervised ML algorithm used for binary classification problems (when the target is categorical). It is widely used in various fields such as medicine, finance, marketing, and social sciences for analyzing the relationship between a binary outcome and its predictors.

$$Logistic\ function = \frac{1}{1+e^{-x}}$$

Logistic regression, despite its name, is a classification model rather than a regression model. Logistic regression is a simple and more efficient method for binary and linear classification problems. It is a classification model, which is very easy to realize and achieves very good performance with linearly separable classes. It is an extensively employed algorithm for classification in the industry.

Certainly! Logistic regression can be used in the context of a personality quiz to predict the likelihood of a candidate being shortlisted for a job based on their personality traits. In logistic regression, the goal is to predict a binary outcome, such as whether or not a candidate will be shortlisted for ajob. The model works by using a set of predictor variables, such as the candidate's responses to a personality quiz, to estimate the probability of the binary outcome. In the case ofa personality quiz for job shortlisting, the logistic regression model might use the candidate's responses to questions about their personality traits (e.g. introversion/extroversion, conscientiousness, emotional stability, etc.) as predictor variables. The model would then estimate the probability ofthe candidate being shortlisted for the job based on their personality traits. It's important to note that logistic regression is just one of many statistical techniques that canbe used to analyze data from a personality quiz. Other techniques, such as decision trees or neural networks, may also be effective depending on the specific application and data available. Additionally, it's important to use caution when using personality quiz data for hiring decisions, as there is a risk of unconscious bias and discrimination.

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Random forest classifier: - Random Forest is a popular machine learning algorithm that belongs to the supervised learning technique. It can be used for both Classification and Regression problems in ML. It is based on the concept of ensemble learning, which is a process of combining multiple classifiers to solve a complex problem and improve the performance of the model.

As the name suggests, "Random Forest is a classifier that contains a number of decision trees on various subsets of the given dataset and takes the average to improve the predictive accuracy of that dataset." Instead of relying on one decision tree, the random forest takes the prediction from each tree and based on the majority votes of predictions, predicts the final output.

Here are 5 steps to understand how Random Forest Classifier works. 1. Sampling Data Randomly. 2. Selecting Features at Random. 3. Creating aDecision Tree. 4. Aggregating the Results. 5. The final and concluding step of the Random Forest classifier is the Prediction of output. A random forest classifier is a machine learning algorithm that is commonly used in classification tasks, such as predicting whether a job seeker would be a good fit for aparticular job based on their personality traits. The algorithm works by building multiple decision trees and combining their results to make a final prediction.

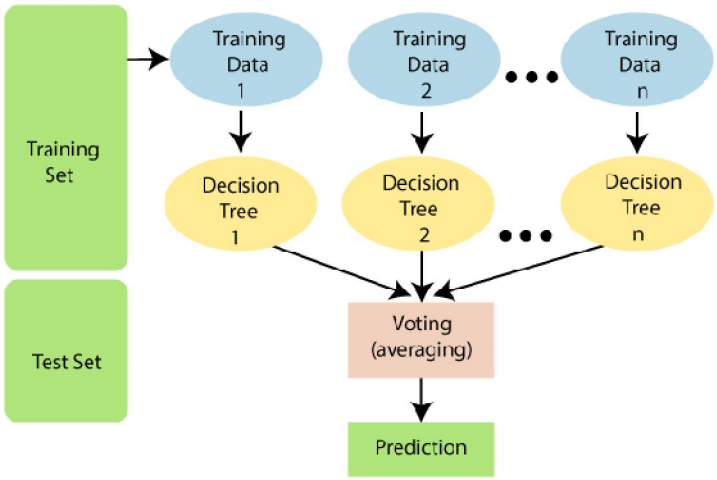

***Figure 1**: Random Forest Classifier*

To use a random forest classifier in a CV/resume shortlist job seekers based on a personality quiz, the following steps could be taken:

Develop a personality quiz that asks questions aboutdifferent personality traits relevant to the job.

Collect the quiz responses from job seekers and use them to train a random forest classifier. The classifier would use the quiz responses as input and the job seeker's suitability for the job as the output.

Use the trained classifier to predict the suitability of new job seekers based on their quiz responses.

Overall, using a random forest classifier can help toautomate and streamline the job-matching process,making it more efficient and effective.

VI. IMPLEMENTATION

In the front-end side i.e., the candidate's part, initially, the applicant has to register on our website. Then, login with the just created account. These details will be saved to our database which will help us to screen out applicants. Further, the link for taking a personality assessment is selected. Take the assessment. Wait for the result to get displayed. The front end on the employer's part is that the assessment response is collected in the Excel sheet as a .csv file.

In the backend, the system is trained with numerous data like trained and test data sets. The data of the candidate is collected using a form and it is given as input to the trained system. Then the machine learning algorithms are applied by using Logistic Regression to predict and Random Forest classifier to classify the data sets into specific categories.

- Collecting candidate data- The first step is to design a registration form so that users can register on the website. This form must be filled out online by applicants; it is not a physical document. Basic information

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including name, contact information, educational background, employment history, and any other pertinent data needed for the position may be collected on the registration form. It is important to note that the registration form is user-friendly and simple to complete in order to motivate applicants to register on the website and take the test.

- Taking Assessment- The next step is to conduct a personality and aptitude test for the applicants when the registration process (which includes signing in) is concluded. The execution of this test will only be done online; there will be no in-person testing. The test is meant to evaluate the applicant's personality traits, communication abilities, analytical capabilities, and other significant qualities necessary for the position. Candidates that have the qualifications and personality types needed for the position should be found by analyzing the test results.
- Storing data into the database- The next stage is to store the data in a database after the personality and aptitude tests have been concluded. For both the machine learning model's input, this data will be used. The database is set up such that it can record the candidate's personal information, educational background, professional experience, and the outcomes of the aptitude and personality tests. The machine learning model will be trained using this data in order to increase its capability of correctly predicting if candidates are eligible.
- Evaluation- This stage involves analyzing the data and using the machine learning algorithm to predict how well the candidate's personality will fit a certain position. In order to evaluate the candidates' eligibility, two algorithms—random forest and logistic regression—are employed. Many decision trees are used by the decision-making process known as random forest to estimate how well-suited each candidate is. A statistical method called logistic regression uses a candidate's biographical information, educational background, and employment history to predict the probability of their personality being suitable for a certain job profile.
- Displaying results- A list of candidates who have been filtered down is then produced by the machine learning model based on their appropriateness according to the personality test that the candidate has appeared for. The candidate's eligibility is determined by the model, which also takes into account numerous aspects like personality traits, aptitude, and education. To find the best applicant for the job, the shortlisted individuals are then further assessed through interviews and other selection processes. This phase is crucial to make sure the best candidate is chosen for the position, as doing so can boost productivity and the organization's overall success.

Data Flow Diagrams: -

The Data Flow diagrams (DFD) belong to structured-analysis modeling tools that are very popular because they help us to visualize the major steps and data involved in software-system processes. Input-to-output transformation in a system takes place because of process function. The symbols of a process are rectangular with rounded corners, oval, rectangle, or circle. Data flow describes the information transferring between different parts of the systems. The arrow symbol is the symbol of data flow, the direction of flow shown by the arrow could also be bi-directional. The data is stored in the warehouse for later use. Two horizontal lines represent the symbol of the store.

Levels in DFD are numbered 0, 1, 2, or beyond. Here, we will see mainly 2 levels in the data flow diagram, which are: 1-level DFD, and 2-level DFD.

1-level DFD: In 1-level DFD, we highlight the main functions of the system and break down the high-level process of 0-level DFD into sub-processes as shown in Fig. 2(a).

2-level DFD: 2-level DFD goes one step deeper into parts of 1-level DFD. It can be used to plan or record specific/necessary detail about the system's functioning.

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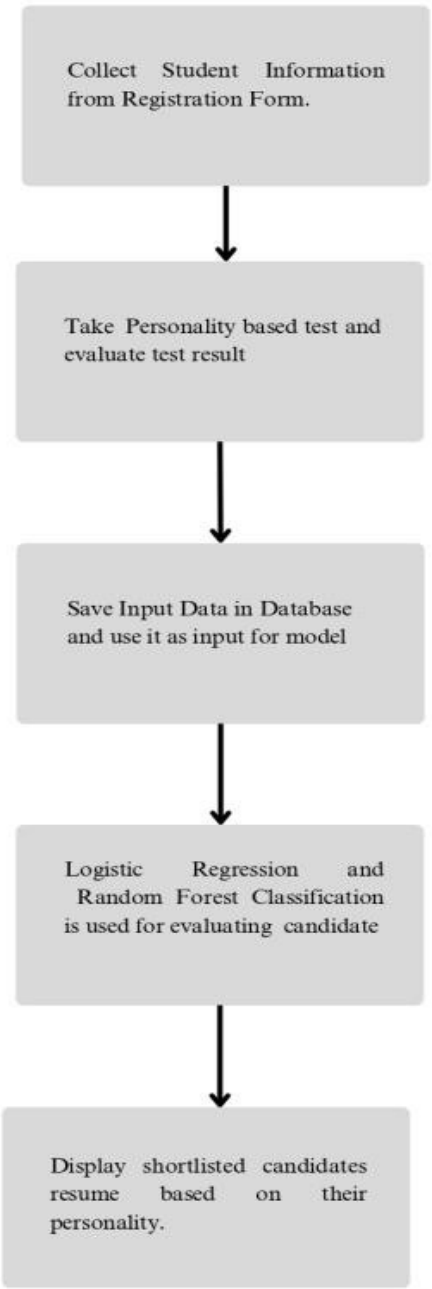
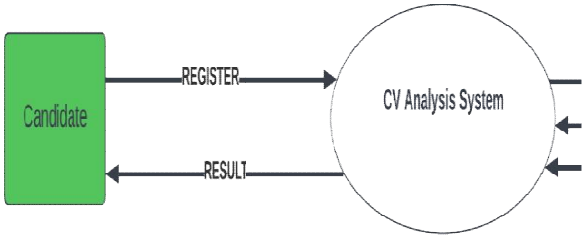


Figure 2: Steps involved



(a)

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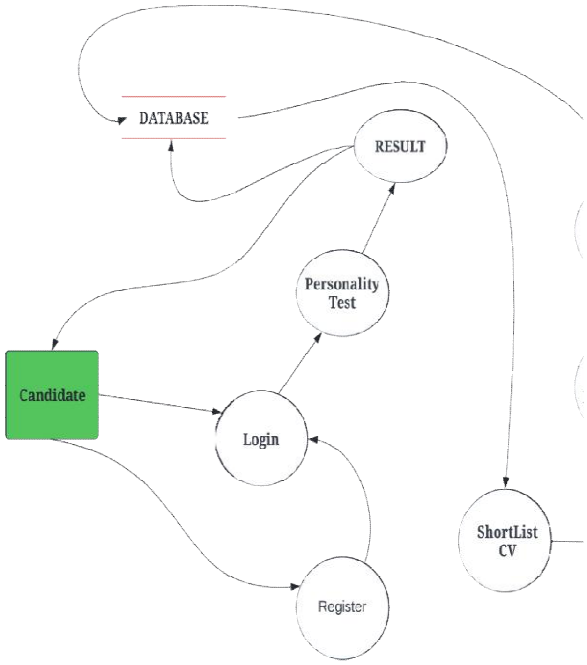

(b)

Figure 3: The figures represent the levels in Data Flow Diagrams. (a) 1-level DFD (b) 2-level DFD.

ER Diagram: -

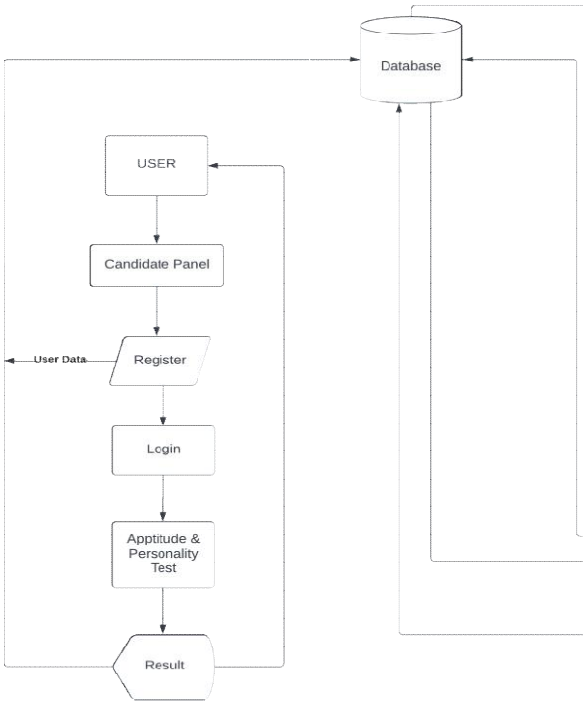

Figure 4: ER DIAGRAM OF SYSTEM

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VII. RESULTS

Figure 5: User Interface

User: -

Figure 6: This figure displays the following multiple options - STUDENTS, ELEMENTS, PAGES, ADMIN, SIGN-UP, REGISTRATION FORM, and CONTACT.

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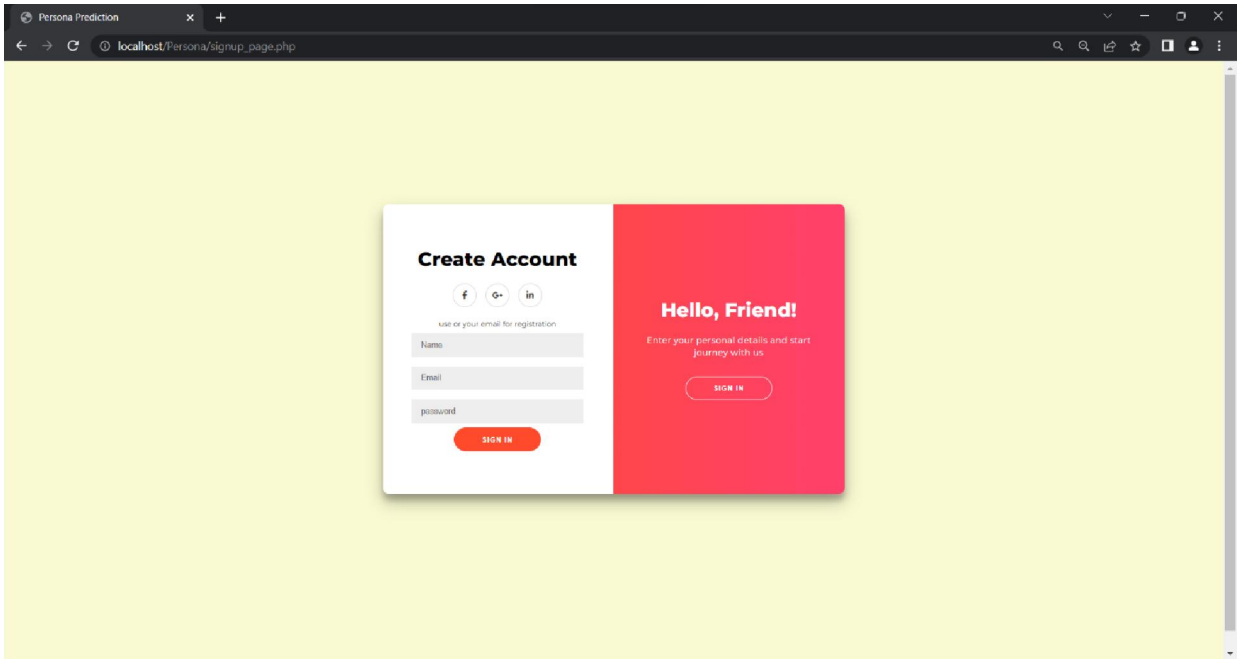

Figure 7: The figure displaying the page where the user account can be created.

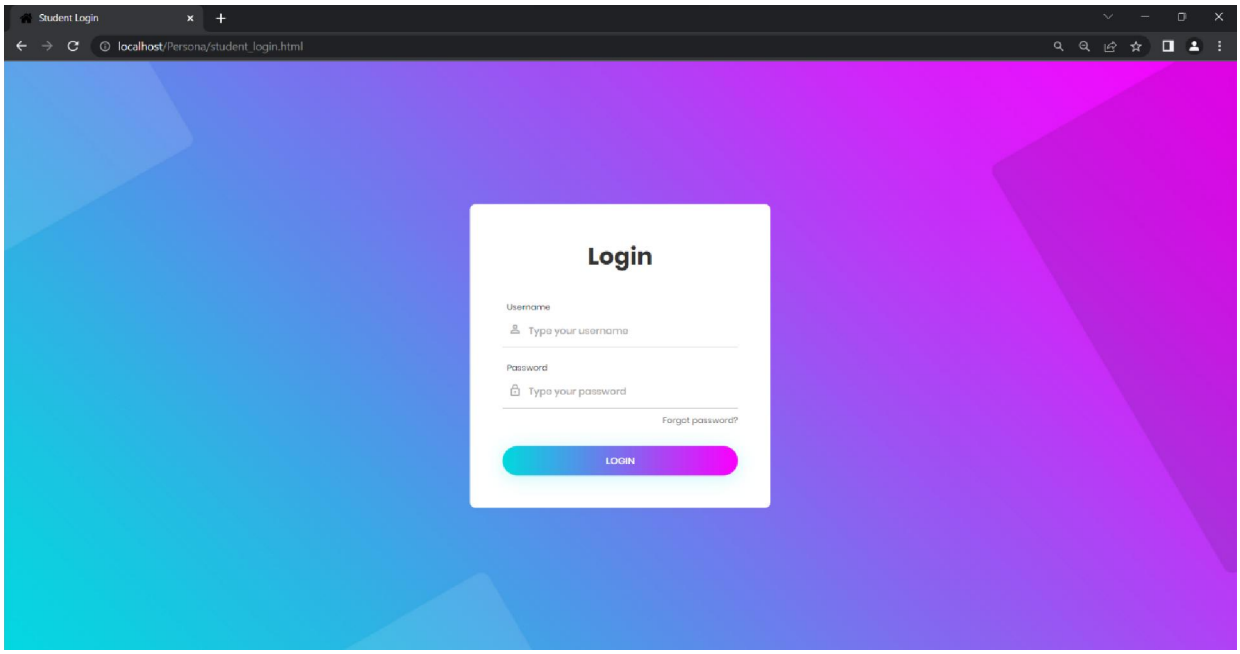

Figure 8: Login page, where the users can login, if they already have an account.

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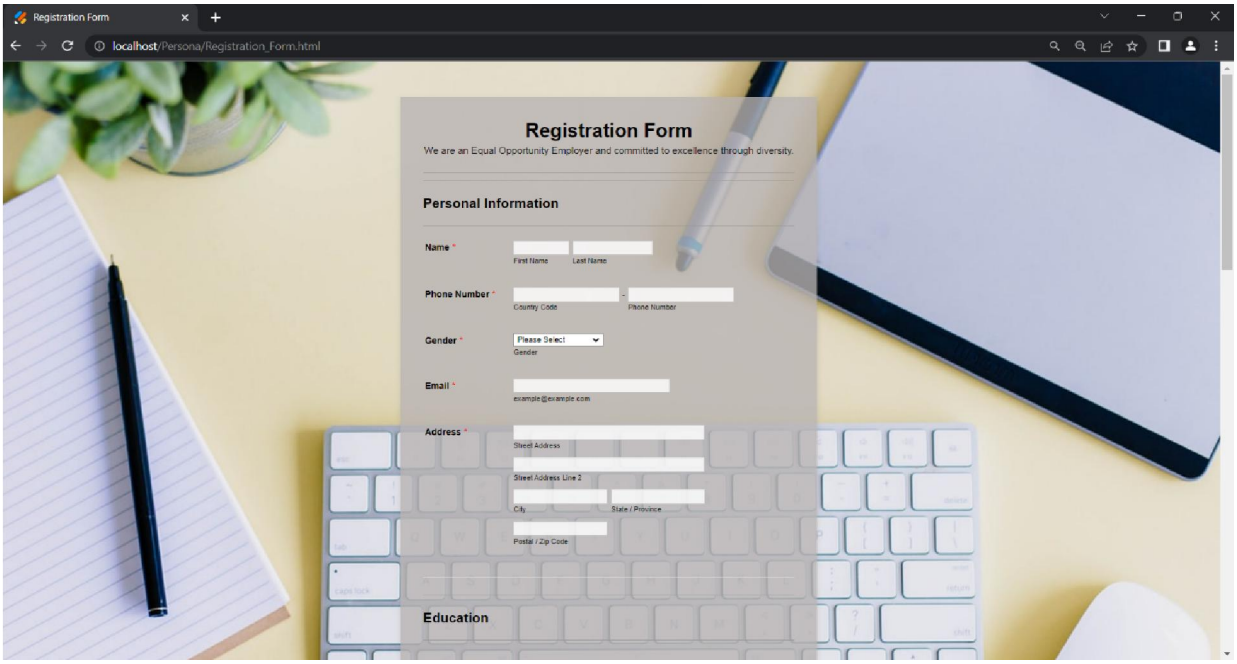
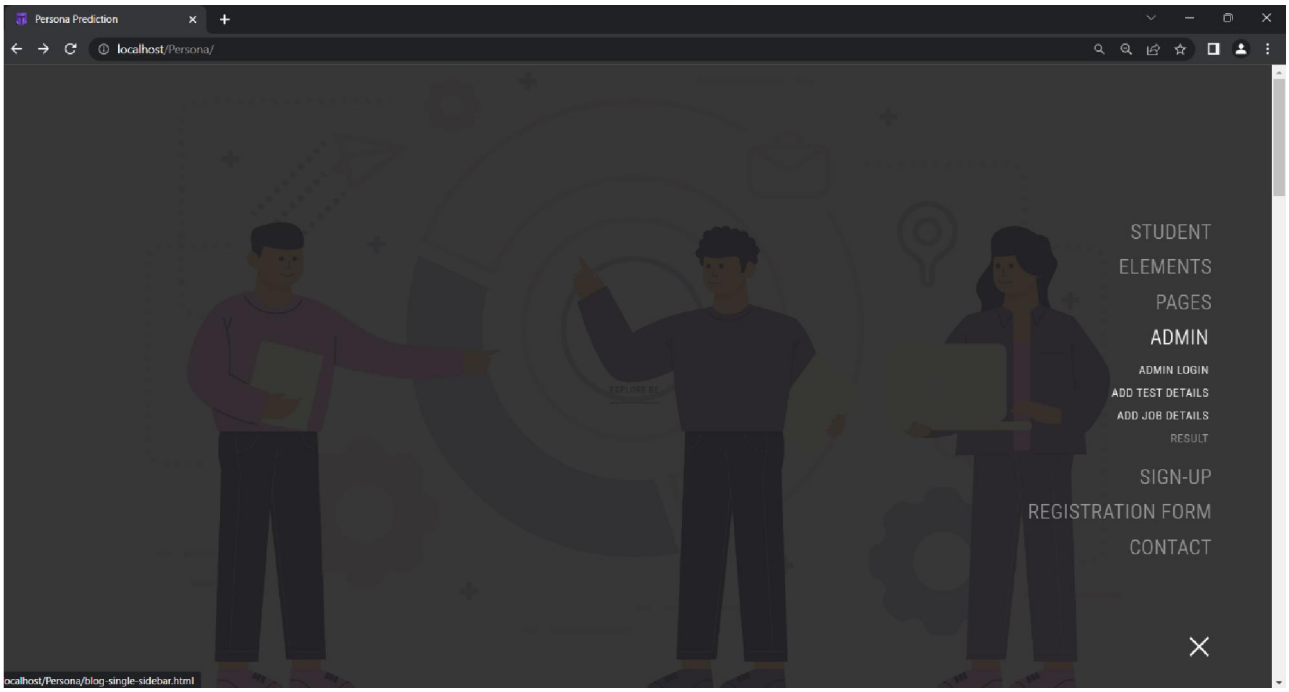


Figure 9: Users Registration Form where details like Name, Phone Number, Email, Education Details, etc have to be filled.

Admin: -



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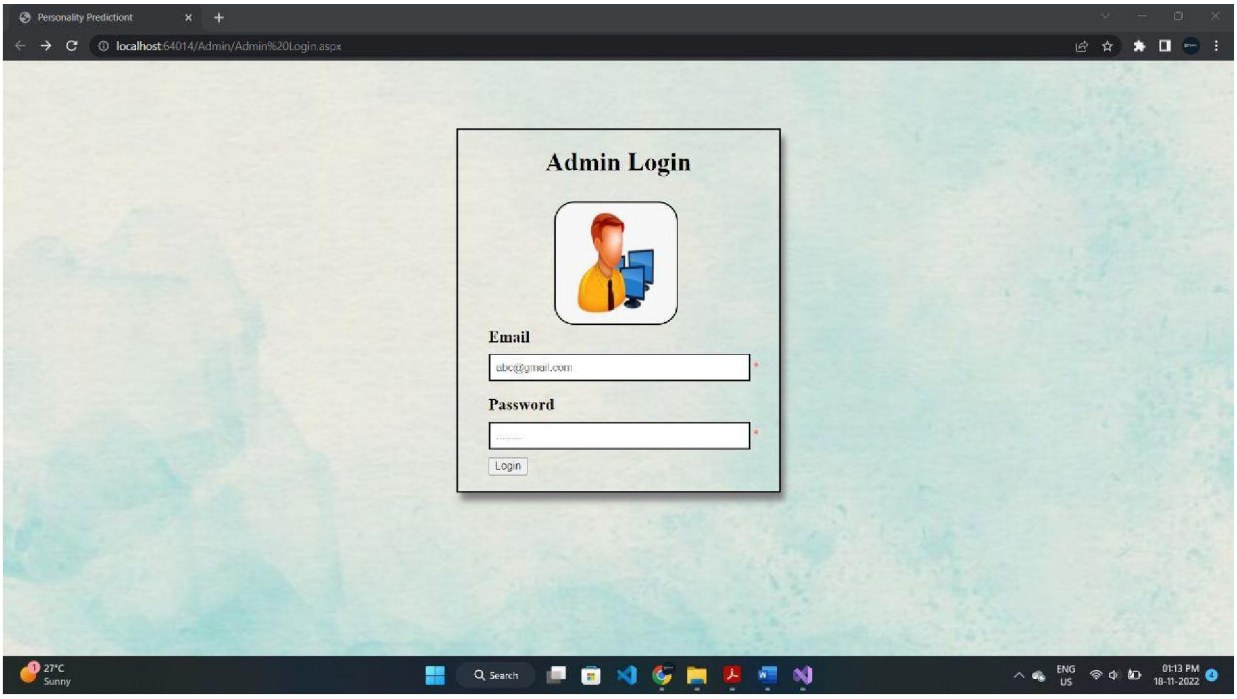

Figure 10: Admin Login page, where HR/Recruiter/Client is able to login.

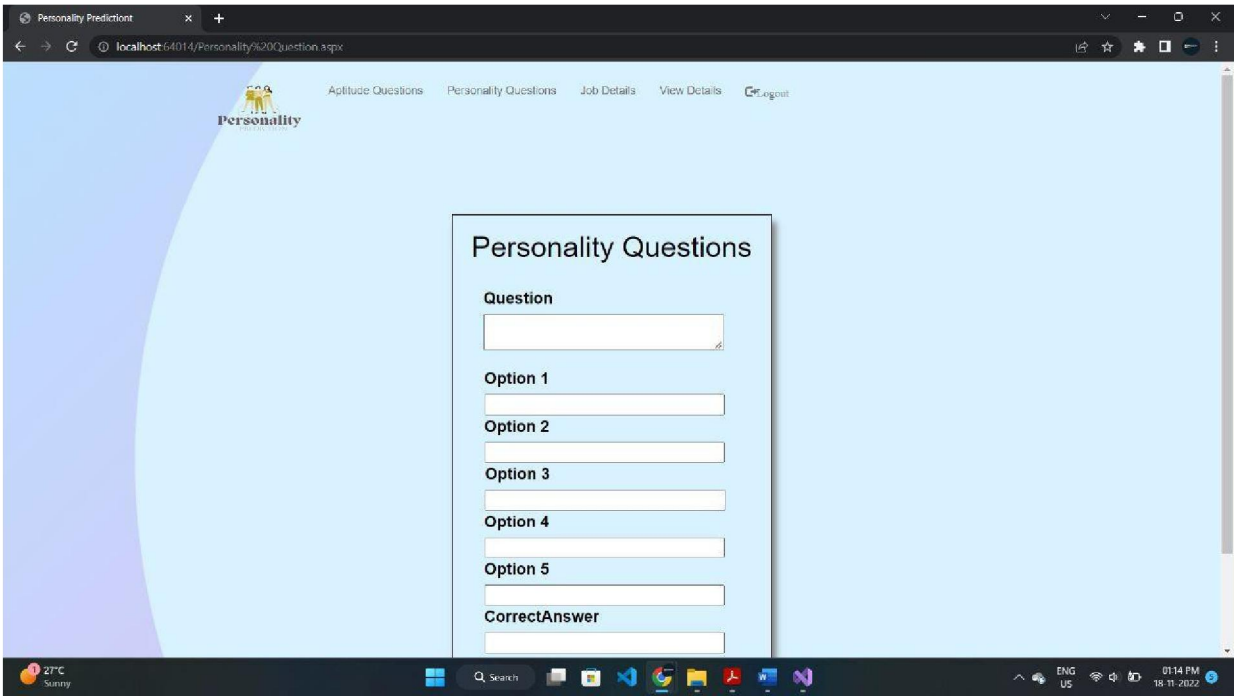

Figure 11: Personality Questions Page where Admin is able to add questions for the user's test.

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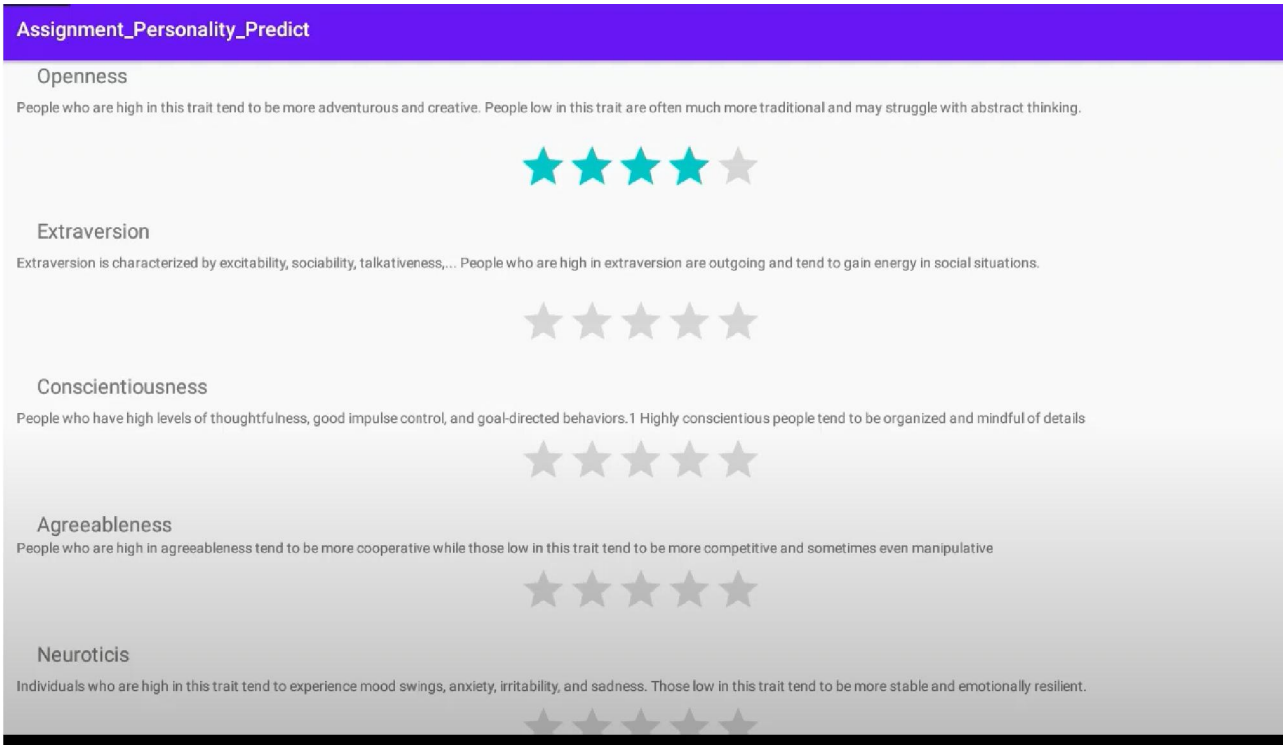

(b)

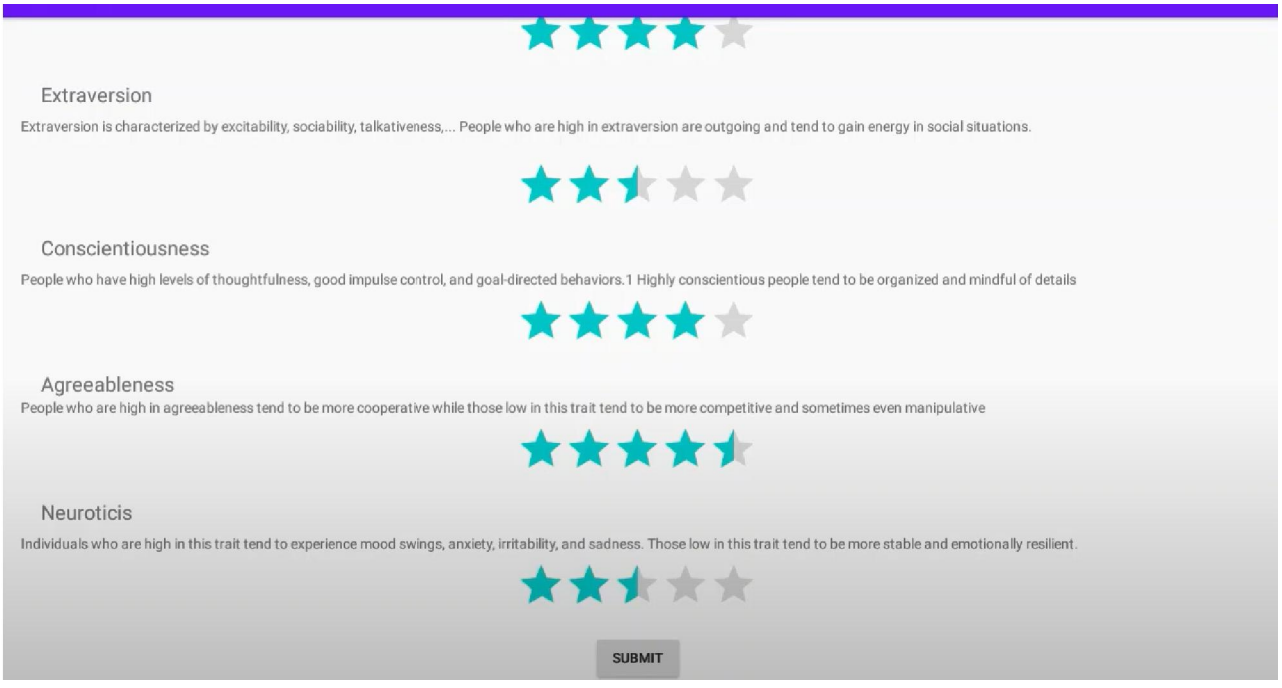

Figure 12: (a) and (b) Examples of test questions and answers.

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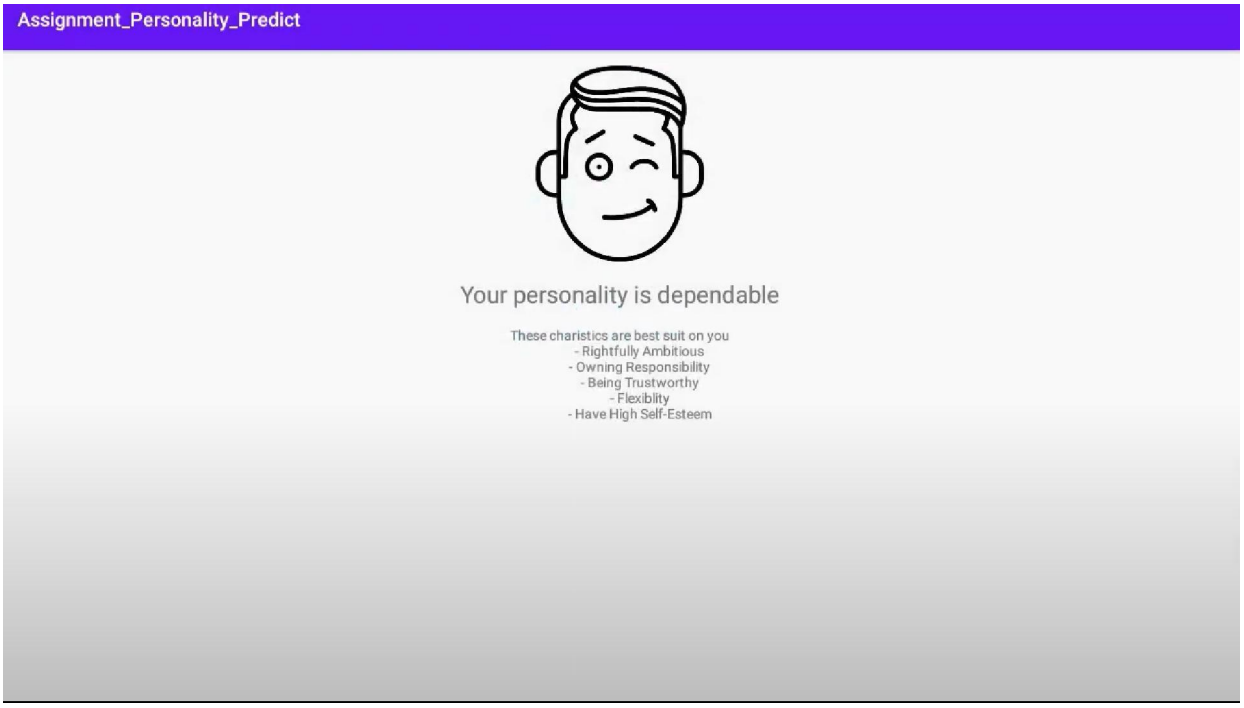
(a)



(b)

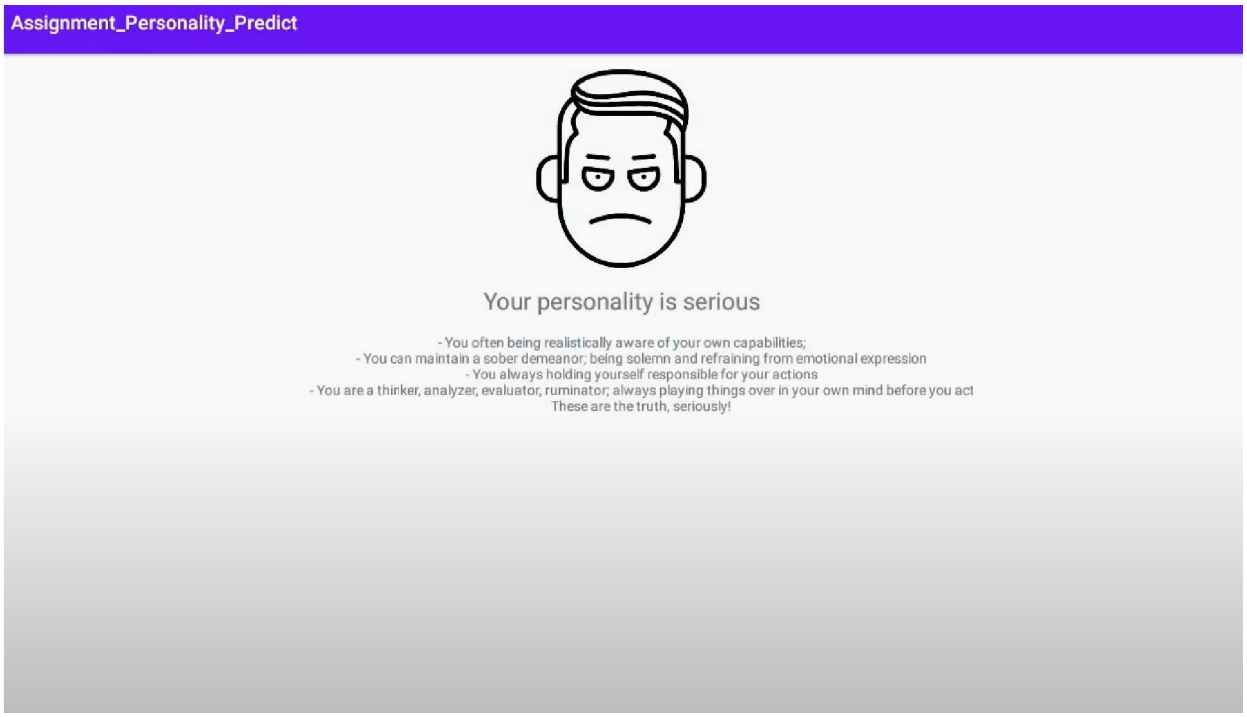


Figure 13: (a) and (b) Examples of Results displayed after the completion of the users' test.

VIII. CONCLUSION

Personality plays an equally significant role in maintaining a stable organization as talent does. With the use of personality testing, you are able to categorize a candidate's personality in accordance with his aptitude and capacity to fit the needs of the firm. With the aid of our initiative, the business is better able to choose the ideal individual. Online

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aptitude and personality tests are used in conjunction with a machine learning algorithm to evaluate the applicant's personality. Each topic in this test has four possibilities, and the candidate will be given a form with multiple choice questions. Based on the candidate's selections, the personality test will measure and predict their personality. Although it is a multiple-choice question, each answer choice is given a weight that ranges from 1 to 4, as we said in our suggested system. Following completion of the exam, each response chosen by the candidate is combined and categorized into one of five values that are supposed to be considered, including extraversion, vivacious, deliberate, authoritative, and trustworthiness. The HR team may quickly narrow down the applicant pool based on expected personality traits and choose the ideal candidate they wish to hire. An applicant should be energetic, vivacious, and able to handle social situations if a corporation wished to hire them for a position in public relations. Someone who is more responsive is more likely to fit for jobs such as customer service representative, teacher, paramedic, etc. The fully automated approach we've suggested is more transparent and readable, which will help it be more productive and less time-consuming for HR to manage.

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