System for Talent Acquisition: Integrating AI, Automation, and Data Analysis in HR

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***Abstract*—This article presents a novel system designed for human resources (HR) companies, aiming to predict an individual's personality based on resume analysis through the integration of advanced information technology tools. At the core of this system is Airable, serving as the central database, which is seamlessly I integrated with various other tools such as PDF.co for document handling, GitHub for code repository management, and OpenAI for advanced AI algorithms. The integration and automation of these diverse tools are skillfully orchestrated using Make, a no-code solution that streamlines the workflow and enhances efficiency. This innovative approach allows HR companies to leverage technology for more accurate personality predictions, thereby improving their recruitment processes and decision-making strategies.**

Keywords— Information technology, Personality prediction, Resume analysis, HR technology, Automation; AI and Machine learning; Design algorithms

I. INTRODUCTION.

In today's rapidly evolving hiring landscape, the quest for identifying top talent has shifted towards advanced tools and strategies. The conventional approach of sifting through advertisements and traditional job boards has given way to a more dynamic and data-driven methodology. Recruiters face the formidable challenge of unearthing exceptional talent from a vast pool of job seekers, a process that demands patience, perseverance, and a deep understanding of the nuances that define potential candidates. To meet this challenge, recruiters require the right set of recruitment tools that provide a 360-degree perspective, enabling them to pinpoint the ideal talent for the job.

The realm of Human Resource Management (HRM) is in a constant pursuit of innovative technologies to enhance the efficiency and effectiveness of the recruitment process. Recent technological advancements have ushered HRM into the digital age, particularly in certain facets of the recruitment process. Electronic methods have injected fresh dimensions into the recruitment landscape, offering a range of powerful tools and techniques to modernize the process. These include the use of social network platforms like Facebook, LinkedIn, Headhunter, and Instagram to attract and engage potential candidates, not only to discover top talent but also to enhance the employer brand's reputation among candidates.

Moreover, company websites provide a platform for job seekers to access information about job openings and submit their credentials. Job boards are widely utilized by HRM to advertise and promote job opportunities, providing job seekers with a convenient platform to explore new possibilities. Online interviews, facilitated by communication technologies such as Skype, Teams, Zoom, and G-meet, eliminate the need for physical meetings, streamlining the candidate evaluation process.

In this context, the integration of information technology and AI-driven methods into the recruitment process holds great promise. As the hiring landscape continues to evolve, it is essential to adapt to these changes. The use of AI-powered software to enhance the hiring process represents a transformative trend in the HRM industry.

Multiple online assessment platforms utilize the name, email, LinkedIn profile ID, or social media accounts of a person to locate their publicly accessible social media content, evaluate it, and generate scores based on widely recognized personality metrics.

Common examples of personality metrics based on the analysis and study results are presented in the Table 1.

1. PERSONALITY SCALE DEFINITION

Scale	Definition
Myers-Briggs Type Indicator (MBTI)	The MBTI is a personality assessment tool that categorizes individuals into one of 16 personality types based on their preferences in four dichotomies: Extraversion vs. Introversion, sensing vs. Intuition, thinking vs. Feeling, and Judging vs. Perceiving.
DISC Assessment	The DISC Assessment categorizes individuals into four main personality types: Dominance, Influence, Steadiness, and Conscientiousness. It focuses on behavioral traits and communication styles to help individuals understand themselves and others better.
Big File	The Big Five personality traits, also known as the Five Factor Model (FFM), include Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. These traits are used to describe and assess an individual's personality characteristics.
Enneagram	The Enneagram is a personality system that defines nine distinct personality types, each with its unique motivations, fears, and desires. It provides insights into an individual's core personality and offers a framework for personal growth.
PAEI Test	The PAEI Test is a personality framework developed by Igor Ansoff. It categorizes individuals into one of four primary managerial roles: Producer (P), Administrator (A), Entrepreneur (E), and Integrator (I). These roles help describe a person's leadership and decision-making style.
Rorschach Test	The Rorschach test is a projective psychological test consisting of 10 inkblots printed on cards (5 in black and white, 5 in color). The test is designed to reveal unconscious aspects of an individual's personality, thoughts, and emotions by analyzing their responses to ambiguous stimuli.

[a] Created by Author based on Review and Analysis

One of the critical areas where this technological transformation can make a significant impact is in personality prediction based on resume analysis. Personality has been scientifically demonstrated as a reliable indicator of job performance, as highlighted by Frank L. Schmidt's research findings, which revealed that relying solely on job experience allows for a mere 16% accuracy in predicting job performance. In contrast, the combination of cognitive ability and personality assessment provides a remarkable 78% accuracy in forecasting future performance [1]. Personality assessments, particularly those based on the well-established "Big Five" theoretical model, offer valuable insights into how a candidate's personality will influence their behavior in the workplace. These assessments enable recruiters to gain a better understanding of how candidates interact with others, approach problem-solving, and manage their emotions.

II. LITERATURE REVIEW

Personality prediction algorithms play a pivotal role in the field of Information Technology, specifically in the context of resume analysis for HR companies. These algorithms employ a variety of approaches, ranging from traditional machine learning methods to advanced neural network models, to analyze data and make predictions about an individual's personality traits.

The first set of algorithms includes well-established methods like the Analytical Hierarchy Process (AHP) and Recommendation Systems. AHP ranks CVs based on numerous factors, while Recommendation Systems utilize content-based and collaborative-based filtering to predict personality traits [2]. These methods provide systematic approaches to candidate selection and trait prediction.

Another commonly used approach for personality prediction is the Regression Method, which assesses the relationship between dependent variables and predicts outcomes. This method can be linear or non-linear in nature, with the linear model typically offering a better description of the relationship [3]. However, it is worth noting that sentiment data may not perform optimally in the regression model, particularly in the context of assessing applicant resumes.

Gaussian Process Regression is another algorithm used in personality prediction. This method represents an underlying function rigorously, incorporating components such as Gaussian distribution, training data, covariance functions, and supervised learning [4]. It is essential to choose appropriate mean and covariance functions based on the available data to effectively employ Gaussian processes for prediction.

M5rule Algorithm is a machine learning algorithm that utilizes rules to explain data and predicts linear models for each rule [4]. Multivariate Linear is a technique applicable when dealing with multiple dependent variables measured using different metrics simultaneously. Another relevant algorithm is ZeroR, which primarily relies on the target variable and disregards all predictors, predicting the majority category. This algorithm is often used for establishing baseline performance benchmarks.

Ridge regression, on the other hand, is particularly valuable when dealing with data that exhibits near-linear relationships among independent variables [5]. It helps address mathematical challenges arising from insufficient information and matrix inversion difficulties.

For regression analysis, you can consider using the Linear Support Vector Machine (SVM), which is a supervised learning model capable of recognizing patterns based on input data and making predictions among two possible classes [5]. Additionally, Logistic Regression is an effective method to measure the relationship between dependent and independent variables using probability scores.

In the context of our system's operation, Clustering Algorithms, such as K-nearest neighbor classifier, may also be of interest. These algorithms are particularly useful when attempting to cluster closely connected groups of data points, integrating both structural and content information to enhance prediction accuracy [6].

Hierarchical clustering and Decision Trees can be beneficial in providing prediction results as a user navigates from the root node to a leaf node [7]. Researchers have developed group recommendation systems based on this model, primarily using structural information as input.

Another valuable addition to our prediction algorithm arsenal is the Bayesian Probabilistic Model. This model, based on Bayes' theorem, calculates posterior probabilities of prediction events, making it particularly useful when dealing with discrete prediction results [8].

The diversity of personality prediction algorithms reflects the complexity and multi-faceted nature of human

personalities. The choice of algorithm depends on the specific characteristics of the data being analyzed and the desired outcomes in the realm of HR and resume analysis. The summary of the getting results of this literature review on an existing and more interesting methods and approaches are presented in the Table 2 below.

2. PERSONALITY SCALE DEFINITION

Authors	Provided system
N. Leena, N. Sandhya, R.S.A. Reddy, S.K. Saheb [9]	Candidates applying for a job take a quiz, fill out details, and upload their CV. The model scans the CV, predicts personality based on the OCEAN model, and displays the results.
A. Robey, K. Shukla, K. Agarwal, K. Joshi, Prof. S. Joshi [10]	Candidates register and upload documents for job applications, meeting specified requirements. The system evaluates eligibility through an online test, ranking candidates based on CV, aptitude, and personality assessments.
A. Kulkarni, T. Shankarwar, S. Thorat [11]	Pyresparser extracts CV data to a CSV file, while SpaCY's PhraseMatcher class assigns scores to OCEAN keywords, labeling traits in a final CSV output.
G. Kaur, S. Maheshwari [12]	Introduces an efficient method for ranking and evaluating candidates based on psychometric analysis of emotional quotient, achieving higher accuracy levels (65% and 87%) compared to previous systems.
R. Narwade, S. Palkar, I. Zade, Asst. Prof. N. Sanghavi [13]	Allows candidates to register, submit CVs, undertake aptitude and personality tests, with scores stored in databases. It employs pyre sparser for CV parsing and NLP libraries like NLTK and spa CY for resume data analysis, predicting personality types based on test results.
M. Muthuselvi, A.R. Mani, Abinaya [14]	The automated candidate grading system employs machine learning for online tests, ranking candidates based on CV, aptitude, and personality results.
J. Rout, S. Bagade, P. Yede, N. Patil [15]	Outlines the application of the TF-IDF algorithm in resume analysis for job selection, explaining the steps of TF and IDF calculations.
A. Anand, Mr. S. Dubey [16]	Automates resume screening by converting PDFs, extracting keywords, ranking candidates based on job requirements.
M. Goyal, S. Shah, A. Sangani, B. Valani, N. Ram [17]	Extends its utility to college clubs, admission institutes, and business schools, offering simplified shortlisting processes
E. Faliagka, A. Tsakalidis, G. Tzimas [18]	The e-recruitment system automates candidate ranking using criteria like education, work experience, loyalty, and personality traits, integrating with LinkedIn for data extraction.

[b.] Created by Author based on Review and Analysis

III. PROPOSED SYSTEM AND APPROCH

In the dynamic realm of Human Resources, the proposed system is aims to provide a novel approach to personality prediction through resume analysis, utilizing cutting-edge information technology to offer HR companies unprecedented insights for informed personnel selection processes.

A. System Architecture

The proposed personality prediction system for HR companies leverages a multifaceted architecture that seamlessly integrates various tools and services to streamline the analysis of resumes and enhance the decision-making process in talent acquisition. As it is shown in the Figure 1, implementation involves a multi-step process that begins with the user submitting general information, a CV or a video resume link, and results from PAEI and 16 Personality tests via an Airtable form. This data is periodically fetched by the Make automation service. For paper-based resumes, the CVs are converted to JSON format using PDF.co, and GitHub information (if provided) is retrieved and parsed into JSON. Both sets of JSON data are then processed by OpenAI to predict personality traits and determine applicant priority. This processed information updates the respective Airtable record. For video resumes, the process involves converting the video into text using ChatGPT Whisper and similarly processing the GitHub information. The combined data is sent to OpenAI for analysis, and the outcome is reflected in the Airtable record. Additionally, the system features a dashboard accessible via a button, providing a detailed view of the applicant's evaluation. This architecture is not only streamlining the recruitment process but also is introduces a novel approach to understanding candidate profiles through non-coding automation (Fig.1).

Fig 1: System Architecture (Created by Author)

Upon completion of the calculation, the system updates the corresponding record in Airtable with the newly derived insights. This includes the prediction of personality traits and the determination of priority for each applicant, both of which are subsequently revealed in dedicated Airtable cells. Additionally, the system incorporates a user-friendly dashboard accessible through a dedicated button, providing HR specialists with a consolidated view of essential information for efficient decision-making in the hiring process.

B. Tools and Technologies

The proposed system leverages a variety of technologies to streamline the workflow, with key components such as Airtable, Make, PDF.co, and others.

Make is a powerful visual platform that allows users to build and automate anything from tasks and workflows to apps and systems. It is a no-code integration and automation platform that is non-linear and intuitive, allowing users to visually create, build, and automate workflows that are limited only by their imagination.

Airtable is a cloud-based software platform that combines the functionality of a spreadsheet with the power of a database. It allows users to organize, connect, and share critical business information in a flexible and scalable way.

PDF.co is an API (application programming platform) for PDF, Barcodes, and Data Extraction. It offers low-code and REST API with over 3,000 integrations. It can be used from Zapier, Integromat, Power Automate, and Airtable. AI, ML, and OCR power it.

OpenAI is an American artificial intelligence (AI) research laboratory that conducts AI research with the declared intention of promoting and developing friendly AI. They offer a range of models with different capabilities and price points for understanding or generating natural language and code (Fig.2).

Fig 2: Potential Replacements (Created by Author)

However, it's worth noting that these technologies can be adaptable based on specific preferences or organizational requirements.

For instance, Airtable, which serves as the central database, could be replaced with Excel or other relational databases depending on the organization's infrastructure and preferences. Make, the no-code integration and automation tool, can be substituted with platforms like Integromat, offering similar capabilities for workflow automation.

The data collection aspect, which currently employs Airtable forms, can be replaced with Google Forms, providing an alternative solution for gathering information in a structured manner. Moreover, PDF.co, the tool used for document conversion, could be substituted with alternative APIs (Application Programming Interfaces) that specialize in PDF manipulation, barcode processing, and data extraction. This flexibility allows organizations to choose API providers that align more closely with their specific needs or provide additional features.

Additionally, React.js is a JavaScript library for building user interfaces, particularly single-page applications where UI updates are frequent. It was used for illustration of applicant data.

These potential replacements ensure that the proposed system remains adaptable to the dynamic technological landscape and caters to the diverse preferences and requirements of HR specialists and organizations. The decision to replace these technologies should be guided by factors such as ease of integration, compatibility with existing tools, and the specific requirements of the proposed personality prediction system.

C. System Implementation

The proposed personality prediction system is designed to optimize the assessment of job applicants' resumes through the implementation of an integrated set of automated tools and processes. The workflow commences with the applicant completing an Airtable form, wherein they furnish general information, attach their CV, and submit the results of both the PAEI and 16 personality tests. The entered data is systematically stored in the Airtable grid for future reference (Fig.3).

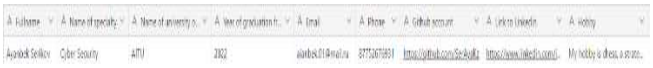

Fig 3: User filling in the Airtable (Created by Author)

At predefined intervals, the Make automation service retrieves the submitted CV file and associated test results from the Airtable database. The CV file undergoes a conversion process to JSON format facilitated by PDF.co. Subsequently, the system initiates an HTTP request to acquire GitHub-related information associated with the applicant, extracting, and parsing this data into JSON format.

For the video-based implementation of the proposed personality prediction system, the process initiates with users submitting their video resumes alongside their general information, PAEI, and 16 Personality test results via an Airtable form. These submissions are periodically retrieved by the Make automation service. The system then employs ChatGPT Whisper to convert the video resume into text, extracting key insights and data.

Concurrently, if a GitHub link is provided, it is used to fetch and parse GitHub repository information into a JSON format. Both the text-transcribed video data and GitHub information are analyzed using a custom formula in OpenAI, which aims to predict the candidate's personality traits and establish their priority ranking. (Fig.4).

Fig 4: Automation service (Created by Author)

Post data extraction, both the CV and GitHub information are transmitted to OpenAI for processing, utilizing a predefined formula. The resulting insights are seamlessly incorporated into the corresponding Airtable record, updating it with the recently acquired information. The personality prediction and applicant priority are dynamically revealed within the Airtable cell, providing Human Resources specialists with crucial insights into each candidate.

Moreover, a user-friendly button embedded within Airtable allows convenient access to a dedicated dashboard for each applicant. This dashboard offers a consolidated view of the processed information, assisting HR professionals in making well-informed decisions during the hiring process. The comprehensive approach of this system enhances the efficiency and accuracy of personality prediction, thereby augmenting the overall recruitment process.

D. Dashboard Design

The website comprises several key pages to facilitate user interaction. The "Home" page serves as the initial landing page, containing general information about the platform or services provided. Users can navigate to the "Sign Up" page to access additional features using Firebase OAUTH authentication (Fig.5).

Fig 5: Home page (Created by Author)

The "CV Analysis List" page is designed to highlight a list of CV applicants or analyses from Airtable Grid View, providing a centralized view for users to browse through available profiles. This page may include summaries or key details about each applicant, allowing users to make informed choices about which CV analyzes to explore further.

For more in-depth information on a specific applicant, users can visit the "CV Analysis Page." This page displays comprehensive details about an individual CV applicant, including their personal information, skills, priority level, and other relevant data.

The analysis may also include visual representations of the applicant's skills through charts and links to additional content, such as CV files or YouTube videos (Fig.6).

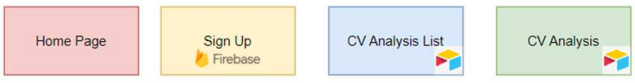

Fig 6: Website pages (Created by Author)

The provided List page is designed to display a list of applicants along with their details in a web application. It utilizes React hooks such as useState and useEffect for state management and data fetching, respectively. The component fetches applicant data from an Airtable database using the base object and organizes it into the applicant's state variable. The formatCreatedTime function is employed to convert the created time of each applicant into a localized string format. The JSX code within the component maps through the applicant data, creating a user interface that includes a table-like structure with columns for applicant number, title, date, and status. Each applicant entry is also linked to a detailed analysis page using the Link component from "react-router-dom."

The styling of the component is achieved through the tailwind css framework, with specific classes applied to various div elements. Conditional rendering is implemented to determine the status of each applicant, displaying "FINISHED" or "IN CHECK" based on the presence of a "Summary" field in the applicant's data. Overall, the component serves as a visually appealing and functional interface for reviewing and navigating through a list of applicants in the context of a web-based application (Fig.7).

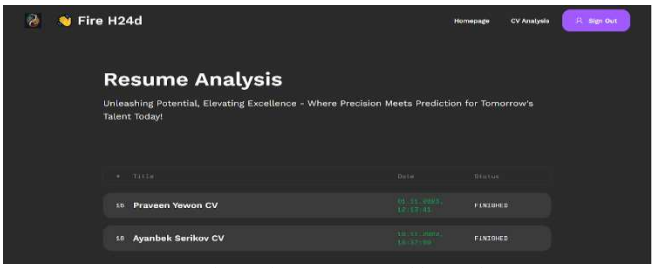

Fig 7: List page (Created by Author)

The provided code represents a web page that displays information about a curriculum vitae (CV) applicant. The page includes sections for header, applicant information, skill charts, and a footer. The applicant's data is fetched from an Airtable database using the Airtable API. The main content is conditionally rendered based on the presence of a "Summary" field in the applicant's data.

If the applicant's summary exists, the page displays detailed information, including the applicant's full name, contact details, priority level, description, tags, and skills. The information is presented in a structured and visually appealing format. The skills are visualized using spline area charts for both soft and hard skills. Additionally, the page includes images related to personality tests and either the applicant's CV file or a YouTube video link.

If the applicant's summary is not available, the page shows a placeholder image and a message indicating that the applicant is currently undergoing an inspection process, asking the viewer to await further information. Overall, the page serves as a detailed and interactive platform for analyzing and presenting information about CV applicants (Fig.8).

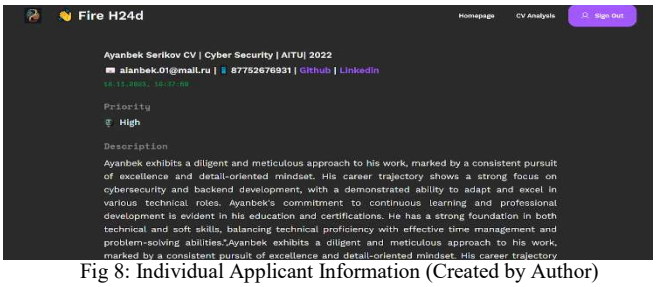

Fig 8: Individual Applicant Information (Created by Author)

IV. RESULTS AND FUTURE WORK

The proposed personality prediction system presents a groundbreaking approach for HR companies, utilizing advanced information technology to analyze resumes and predict personality traits. This system has demonstrated significant potential in enhancing the efficiency and accuracy of the talent acquisition process. By leveraging a combination of Airtable, Make, PDF.co, OpenAI, and ChatGPT Whisper, the system effectively processes both paper-based and video resumes, offering comprehensive insights into candidate profiles. The integration of these technologies allows for a streamlined workflow, enabling HR professionals to make well-informed decisions swiftly. In the future, the system could be further refined by incorporating more sophisticated AI models for deeper personality insights and expanding the range of data sources for a more holistic candidate analysis. Additionally, exploring the integration with other HR management tools could enhance its utility in various HR processes.

The system's primary strength lies in its comprehensive integration of diverse data sources, providing a well-rounded profile of each candidate. The automation of data processing, facilitated by tools like Make, PDF.co, and ChatGPT Whisper, significantly enhances efficiency by reducing manual effort and expediting the recruitment process. The application of advanced AI through OpenAI for personality prediction offers deep, data-driven insights, potentially improving the quality of candidate selection. Additionally, the user-friendly dashboard design ensures that HR professionals have a clear and consolidated view of applicant evaluations, streamlining decision-making and enhancing the overall user experience.

The system's complexity, stemming from the integration of various tools and services, could pose challenges in terms of maintenance and troubleshooting. Its heavy reliance on external services such as Airtable, PDF.co, and OpenAI introduces risks associated with service availability and API changes. Data privacy emerges as a significant concern, especially given the sensitivity of the personal information handled, necessitating robust security measures to prevent breaches. Furthermore, there is a potential risk of bias in AI-driven personality predictions, which could lead to unfair hiring practices if not properly monitored and addressed.

The system offers scalable capabilities, allowing it to accommodate growing data volumes and more complex analyses as organizational needs evolve. There's a notable opportunity to integrate this system with other HR management tools, creating a more comprehensive HR technology ecosystem. The field of AI is continually advancing, presenting possibilities for ongoing improvements in the system's analytical accuracy and insight generation. Additionally, the system's adaptability makes it a prime candidate for customization to meet the specific requirements of different industries or organizational contexts.

A significant threat to the system is the rapid pace of technological advancements, which could lead to certain components becoming obsolete. Security risks are another critical concern, as the handling of extensive personal data opens up the possibility of breaches and data theft. The system must navigate an evolving regulatory landscape, particularly regarding data protection laws, which could impact operational procedures. Lastly, the system's dependency on third-party services like Airtable and OpenAI poses a risk, as any changes in these services' terms, pricing, or availability could disrupt its functionality.

V. CONCLUSIONS

In conclusion, the development of an information technology system for personality prediction based on resume analysis represents a significant advancement in the field of HR technology. This system not only simplifies the recruitment process but also introduces a new dimension in understanding candidate profiles through innovative, non-coding automation techniques. Its ability to integrate various tools and services, such as Airtable, Make, and OpenAI, into a cohesive framework demonstrates its versatility and potential for wide-ranging applications in HR companies. The system's flexibility in accommodating different technologies and its user-friendly dashboard further enhances its appeal to HR specialists. As the technology landscape continues to evolve, this system stands as a testament to the possibilities of leveraging information technology to revolutionize talent acquisition and management.

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