Robotics' Framework for IT Recruitment

Prof. A.V. Kanade[1], Prof. M.A. Rane[2], Smiti Sunil Chandwadkar[3], Yogita Sunil Khalate[4], Tanaya Harishchandra Mane[5], Ghanishtha Anil Rane[6]

[1,2]Assistant Professor Department of Information Technology Bharati Vidyapeeth's College of Engineering for Women (SPPU) Pune, India.

[3-6]Department of Information Technology Bharati Vidyapeeth's College of Engineering for Women (SPPU) Pune, India.

Emails: *ashwini.kanade@bharatividyapeeth.edu[1], Mugdha.Rane@bharatividyapeeth.edu[2], smitichanwadkar91@gmail.com[3], yogitakhalate711@gmail.com[4], tanayamane7275@gmail.com[5], ghanishtha2002@gmail.com[6]*

Abstract

The chatbot functions as a virtual assistant for engaging with candidates. Robotic framework for IT recruitments uses chatbot system for automating recruitment processes. With a growing pool of varied candidates and a growing need for experienced workers, the IT recruitment market is changing quickly. The robotic framework for recruiting is an automated hiring method that speeds up the hiring process by doing away with the need for the recruiter to physically be present. Our study will provide a novel strategy that incorporates all phases of a typical hiring procedure with appropriate oversight, giving the candidate a face-to-face interviewing experience. Organizations' methods for finding and onboarding talent have been completely transformed by the use of robotic technologies in IT recruitment procedures. First of all, automating the job application process simplifies the preliminary communications with candidates, increasing productivity and cutting expenses for HR departments. The need for effective and efficient procedures in the current IT hiring environment is constantly rising. The idea of an intelligent chatbot designed especially for the IT recruitment industry is presented in this abstract. By using machine learning techniques and natural language processing (NLP), this chatbot seeks to expedite the entire hiring process—from finding candidates to onboarding them. The chatbot can do first screening based on predetermined standards established by recruiters, gather and evaluate resumes from prospects, and converse with them in real time. In addition, it makes it easier for recruiters and candidates to communicate smoothly by setting up interviews, sending automated follow-up messages, and giving regular updates on the status of applications.

Keywords: Chatbot, IT recruitment, Candidate screening, Interview scheduling, Resume parsing

1. Introduction

A recruiting chatbot is software which is designed to replicate human conversation during the hiring processes. Recruitment Chatbot is software or platform which relies on Artificial Intelligence for communicating with users and automating processes. I It is a framework which work as a software robot for performing repetitive tasks involved in IT recruitment like resume screening, Resume parsing, interview scheduling. Chatbots are trained for screen resumes for information by applying as per job profile given by HR. Nowadays, Recruitment chatbot system used by various organizations because after

covid-19 online recruitment processes increased rapidly. Our proposed system will enhance traditional hiring system by utilizing Python, SQL Django. This system helps hiring manager for hiring candidates among large applications by saving cost and man-power. The traditional methods are time- consuming, resource-intensive; Organizations are turning to AI-powered chatbots to automate various aspects of the recruitment journey, from receiving and processing job applications to conducting, scheduling interviews and sending reminders.

2. Related Work

Chaudhari, Y., Jadhav, P., & Gupta, Y. (2022) [1] Chaudhari, Y., Jadhav, P., & Gupta, Y. (2022) presented a research study on automating the recruitment process. The authors proposed a system that leverages natural language processing (NLP) techniques to extract relevant information from resumes, enabling enterprises to streamline complex workloads and processes effectively. The first stage of their system involves resume screening using NLP, which facilitates the extraction of key details from resumes. Candidates are then shortlisted for individual video interviews conducted by a bot. [3] This study incorporates question generation with answer evaluation, Deep fake technology, and face proctoring. Vectorization, specifically using the TF-IDF (Term Frequency-Inverse Document Frequency) method, is employed in question generation. TF-IDF is an algebraic paradigm used in text mining and NLP to represent and process textual data efficiently. The question generation module utilized a dataset comprising 1000 descriptive questions and answers. The Deep fake module enhances the interview experience by generating realistic videos using Google Text-to-Speech technology and the "Make It Talk" repository. The bot conducts interviews using pre-stored questions for shortlisted candidates based on their resumes. Additionally, the system includes an automated technical quiz to assess the knowledge of candidates mentioned in their resumes. This ensures a comprehensive evaluation of candidates' capabilities beyond just their educational qualifications or courses completed. Bharti Pandya, Mohand Tuffaha, M Valencia Politecnica Rosario, 2022 A qualitative examination of chatbots has been

conducted at a few Indian businesses. This study shows that hiring mid-level and senior level positions is where chatbots fall short. This study offers a thorough review of the benefits and drawbacks of chatbots in the Indian recruitment process, which should stimulate the minds of HR managers and academics. [4] Data collecting for the research technique involves interviewing seasoned recruiters from renowned Indian organizations who have integrated cutting-edge technology into their hiring procedures. The main goal of the study is to evaluate the usefulness of chatbots in the recruitment process and examine their current state, especially in the Indian market, which is known for its cutting-edge technological advancements. This piece of research is designed to explore the usefulness and limitations of chatbots in the recruitment process in India. This paper simply describes information about construction of chatbot in theoretical manner. Koivunen, S., Ala-Luopa, S., Olsson, T., & Haapakorpi, A. (2022) [4]. explore the concept of recruitment chatbots as a burgeoning element of e-recruitment, providing a user-friendly platform for interaction between recruiters and applicants. The paper specifically examines recruitment chatbots, which are defined as web-based, publicly accessible, and task-oriented bots designed to communicate with potential candidates, collect their information, and assist recruiters with inquiries. The research aims to aid in the advancement of future chatbot-based e-recruitment systems by offering insights centered on users and their activities, particularly from the recruiters' perspective. [5] It outlines several key practical motivations for deploying recruitment chatbots: Attraction bots can reach candidates who are missed by other e-recruitment methods. Customer service bots can attract high-quality applicants by offering proactive assistance. The user interface of chatbots enhances accessibility and reduces the barriers to applying. This study's approach provides a fresh perspective on the use of chatbots in recruitment, emphasizing their potential to improve interaction and efficiency in the recruitment process. Narang, V., Sharma, J., & Saveetha, D. (2022) [2] Narang, V., Sharma, J., & Saveetha, D. (2022) examine the importance of web portfolios and

provide a detailed description of chatbots, their functions, and the process of creating a chatbot using the RASA Framework. Their system includes an AI Bot equipped with frequently asked interview questions for users to answer, allowing recruiters to review the responses. Additionally, the chatbot can automatically check for matching skills based on the recruiter's requirements. [6] The authors aim to develop a chatbot capable of generating likely and human-like replies with grammatically correct and accurate sentences. The technology used to develop this AI-based chatbot includes Neural Networks with logistic regression and various NLP algorithms. Data preprocessing techniques are employed to convert text into binary and numerical formats, facilitating the model's understanding of the input. MongoDB is utilized for storing user data and managing the database, while APIs handle the sign-in and login processes. The project demonstrates significant potential for future enhancements, such as video conferencing, messaging, and personal profile pages. The use of MongoDB and RASA frameworks has contributed to the project's overall productivity and effectiveness. Siswanto, J., Suakanto, S., Andriani, M., Hardiyanti, M., Kusumasari, T.F., 2022[8] detail the creation of an interview bot designed to assess competency using the behavioral event interview method with artificial intelligence. [7] This system automates the interview process to evaluate an individual's competency levels based on their past behavioral experiences. The development of the interview bot involves two primary activities: the first is the data training process to create learning models that determine competency levels from valid participant responses, and the second is the testing and evaluation model used for assessment. The authors found that their method could accurately predict a person's competency levels based on their responses. Their approach demonstrated acceptable accuracy, making the interview bot a valuable tool for conducting online interviews and supporting the assessment center process, particularly under physical and social distancing constraints. [9] The paper reports the successful development of an interview bot using machine learning to evaluate competency levels. This research utilized an Indonesian language dataset and employed NLP technology for interactions with human participants; achieving high accuracy in various scenarios This system does not include resume screening and feedback collection. We have studied many research papers from that this 5 papers are mostly related with our problem statement. By reading tis we found some limitations and gaps. [10] Some papers contain modules about interview conduction, other contains chatbot technology. No details study of robotic framework for it recruitment contains. Our system different logins for different user and HR then easily resume screening from data filled by user, Update sending through mail. Out system helps HR as well as user so that they can save time. [11]

3. Proposed System

The robotic framework for it recruitment process involves automated hiring. Our proposed system utilizes chatbot system for choosing candidate fairly and presenting best candidate among large applications. Conventional hiring practices involve recruiters spending the entire day on college campuses testing new hires, while hiring managers squander time interviewing and assessing experienced prospects for testing purposes. As all Google platforms have developed user-friendly chatbots in recent years. [12] Our technology will offer a chatbot that will offer solutions for conventional method of selecting candidates for employment. The candidate will enter information into our system in the form of a résumé, project specifics, qualifications, abilities, and experience, along with their name, email address, and mobile number. [14] When HR posts a job description, the chatbot will save important information from the form filled by the candidates in a database and use a candidate matching algorithm to shortlist candidates who would be a good fit for the position. In our system which is designed for both user and hiring manager, both needs to register and login by using username and password. [13] In users portal after logging user will fill application form which contains field like name, email, contact, experience, domain, skills, resume. In hiring manager means admin portal when HR will ask chatbot for python developer it will give extract python developer from database and

schedule test for them. Chatbot will shortlist candidate based on some predefined score for text (technical quiz). Then chatbot will schedule interview as per hiring manager's convenience and notify it to user. Feedback from the user regarding the interview process and chatbot has been taken into account. System objectives are:

1. Identify Recruitment Pain Points: Identify specific challenges in IT recruitment that could be addressed by robotics, such as candidate screening, skill assessment, or interview scheduling.
2. Feedback and Iteration: Gather feedback from HR professionals, IT recruiters, and candidates to refine the robotics framework iteratively, improving its effectiveness and usability.
3. Evaluate Existing Technologies: Assess current robotics and AI technologies applicable to recruitment processes, focusing on their strengths and limitations.
4. To automate job application process: The chatbot receive and process job application, allowing candidate to submit their resumes.
5. To interview scheduling and reminders: The chatbot will schedule interviews and send reminders.

4. System Design

IT recruitment chatbot designed for HR and user in the process of recruitment. It involves creative, scalable and efficient solution by involving designs, components, architecture, and technical languages. (Refer figure 1).

4.1. Working of the system:

1. This system involves login for hiring for posting jobs and user for applying jobs.
2. User login involves first registration and then login. For applying jobs there is applications form which contains fields as name, email, contact, domain, address, resume, skills.
3. Hiring manager also involves registration after that login he can post job descriptions.
4. Chatbot will take technical quiz of those candidate's resume matching with job description as hiring manager.
5. Chatbot schedule interviews between hiring manager and user.
6. Based on results given by hiring manager chatbot will ask for feedback to user.
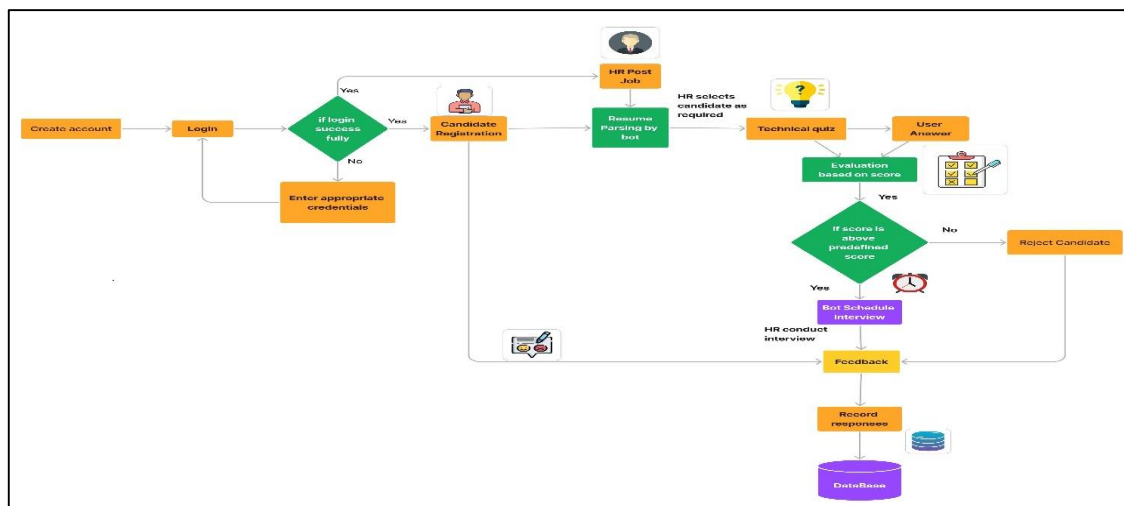

Figure 1 System Architecture

4.2. Modules

- **Login/SignUp Module:** A user can register on bot by creating their username and password by using Signup page. After a successful register user can login into system by using username and password.
- **Chatbot Module:** A Python package called Chatterbot is used to create chatbots those shortlist candidates, scheduling interview,

candidate matching.

- **Resume Parsing Module:** To extract relevant information from resume NLP is used. The information includes skills, experience and qualification.
- **Resume Screening Module:** When HR post job requirement this module will create a list of matching candidates by assessing resume based on criteria.
- **Technical quiz module:** This module creates technical quiz for recruitment assessment.
- **Interview Scheduling Module:** This module is used scheduling interviews as per HR's and candidates convenience.
- **HR module:** Hiring manager post job requirement.
- **Feedback Module:** This module collects candidate's feedback about their recruitment process to improve process.

5. Algorithms

5.1. Scitkit-Learn

This is a library in python which provides many supervised and unsupervised learning algorithms. We used 1.4.2 version which includes all the features, bug fixes and improvements up to that particular release of version. pip install scikit-learn==1.4.2

5.1.1. Following are the Functionalities Scikit-Learn Provides:

- Regression
- Classification
- Clustering
- Model selection
- Preprocessing

5.1.2. Imported Libraries:

- **LancasterStemmer** - This is used for stemming words in the text.
- **Train_text_split** - Which is used to split data into training and testing sets.
- **MultinimiaINB** - Which is Naïve Bayes classifier suitable for classification with discrete features.
- **Accuracy_score** - Which is used to evaluate the accuracy of the classifier's predictions.
- **Feature Extraction** - The `CountVectorizer` is a tool used to transform text data into a matrix of token counts. By calling the

`fit_transform()` method on the `resume_text` column of a Data Frame (`df['resume_text']`), the text data is converted into a matrix `x`. This matrix represents the count of each word's occurrences in the corpus.

5.2. Django

Django is a sophisticated web framework for Python, aimed at facilitating quick development and maintaining clean, pragmatic design principles. It simplifies the process of building web applications by offering a comprehensive set of tools and features to manage typical web development tasks efficiently. Django 5.0, the latest version, was released on March 1, 2024. Features of Django:

1. **MVT (model-view-template) architecture:** MVT which means model, view and controller which separate data model, user interface and application bugs.
2. **Middleware:** Allow developer for enabling features like authentication and error handling.

5.3. Natural Language Processing

As Shown in Figure 2, Natural Language Processing (NLP) is a sophisticated approach that combines rule-based modelling of human language with statistical and machine learning models. This fusion empowers computers and digital devices to comprehend and produce text and speech. As a subfield of artificial intelligence, NLP's primary objective is to facilitate computer systems in understanding and generating human language in a practical and beneficial manner.

1. **NLTK (Natural Language Toolkit) -** It is a library for natural language processing which helps for tokenization, stemming, tagging, parsing and semantic reasoning
2. **markdown-it-py -** It is used for parsing.
3. **Mdurl -** A library for URL manipulation.
4. **Regex -** This library is used for text processing, includes tasks like extraction and pattern matching.
5. **Spacy -** spacy is NLP library for part-of-speech tagging.
6. **Tensor Flow -** It is also known as deep learning library, it offers functionalities such as text preprocessing and manipulation.
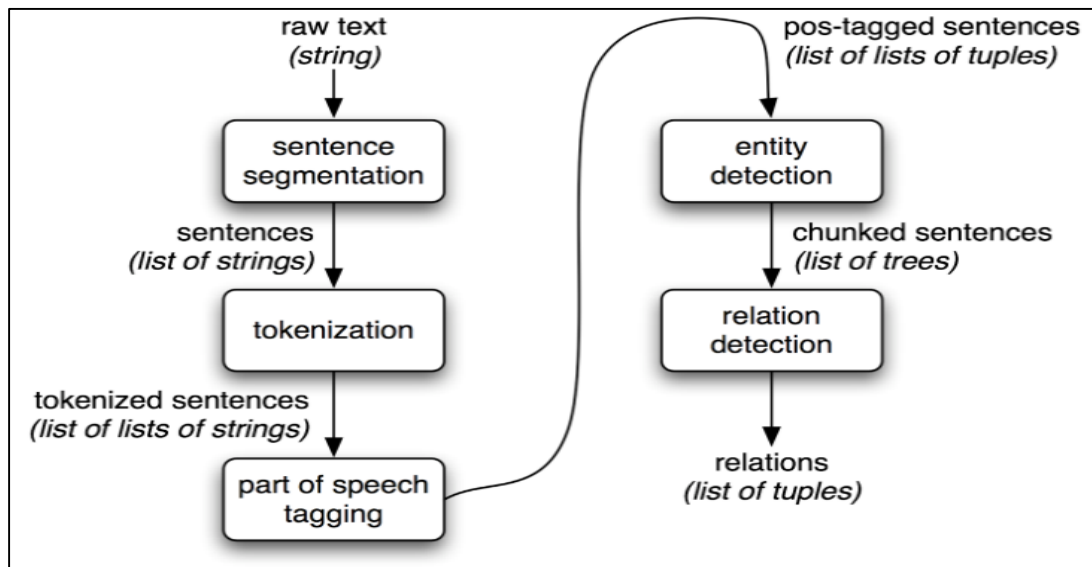
Figure 2 Natural Language Processing

5.4. Python

Python is the programming language used in Django. It supports various programming paradigms, such as object-oriented and functional programming. Created in the 1980s, Python runs on multiple platforms, including Windows, macOS, Linux, and Raspberry Pi. Its design emphasizes readability, making it somewhat similar to the English language, which enhances its accessibility and ease of use. It relies on indentation. Resume Parsing: A resume parser extract, analyze and organize data from resumes to identify suitable candidates. This process streamlines the recruitment process, minimizes errors and saves time. it involves software algorithms to extract key data such as name, contact information, experience, domain, resume, skills. This information used for job matching. Resume Screening: It is the process of reviewing a resume to determine candidate resume matching with job profiles or not. It involves analyzing the content of the resumes against predefined criteria such as skills, qualifications, experience, and job requirements. This initial screening helps hiring managers or recruiters to efficiently shortlist candidates who meet the desired qualifications, thus narrowing down the pool of applicants for further consideration. Automated tools or Applicant Tracking Systems (ATS) are often used to assist in the screening process, facilitating keyword matching and filtering based on specified criteria.

5.5. Schedule Function

It is a function used to schedule events to occur at specific times or intervals automatically. Pip install scheduler. Scheduler Functions-

- **schedule.every(interval=1):** Schedules a new periodic job using the default scheduler instance with the specified interval.
- **schedule.run_pending():** Executes all jobs that are scheduled to run on the default scheduler instance.
- **schedule.run_all(delay_seconds=0):** Runs all jobs on the default scheduler instance, regardless of their scheduled time.
- **schedule.idle_seconds():** Returns the number of seconds until the next scheduled job on the default scheduler instance.
- **schedule.next_run():** Provides the date and time for when the next job is scheduled to run on the default scheduler instance.
- **schedule.cancel_job(job):** Removes a scheduled job from the default scheduler instance.

6. Implementation

Figure (3-10) explains the Implementation Process of the Proposed System.
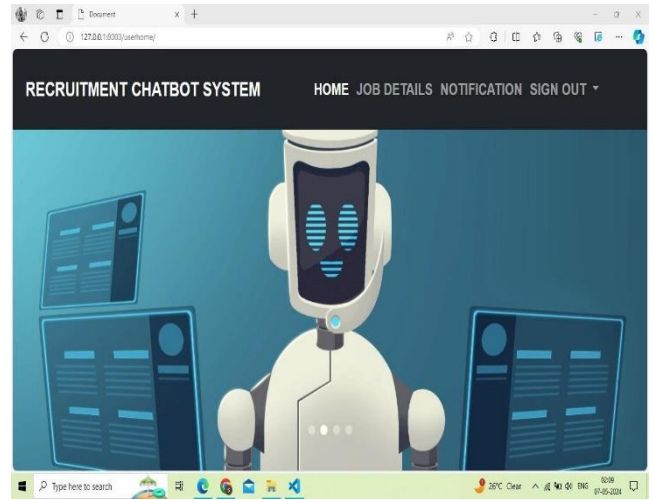
Figure 3 Home Page
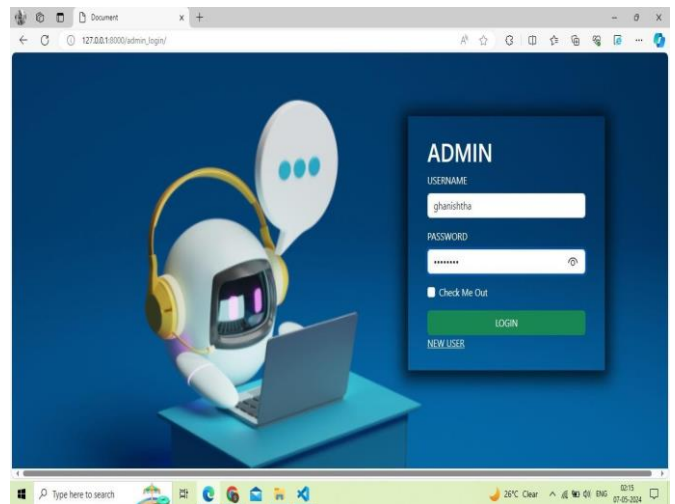

Figure 6 User Home page

Figure 4 Registration Page

Figure 7 Admin Login
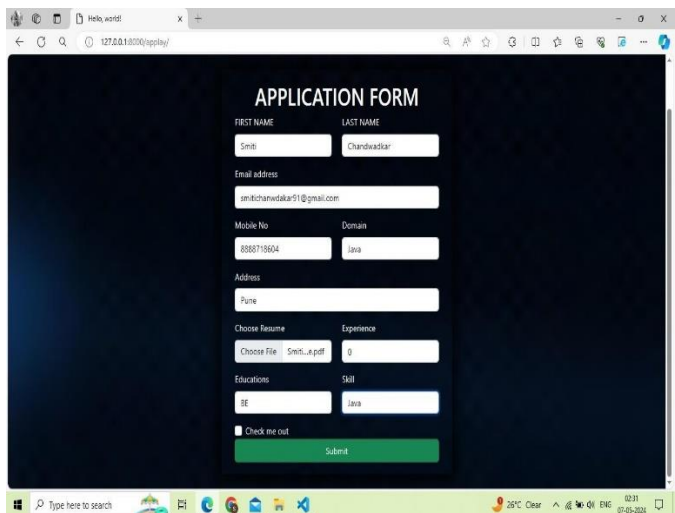

Figure 5 User Login
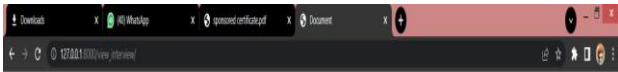

Figure 8 Application Form
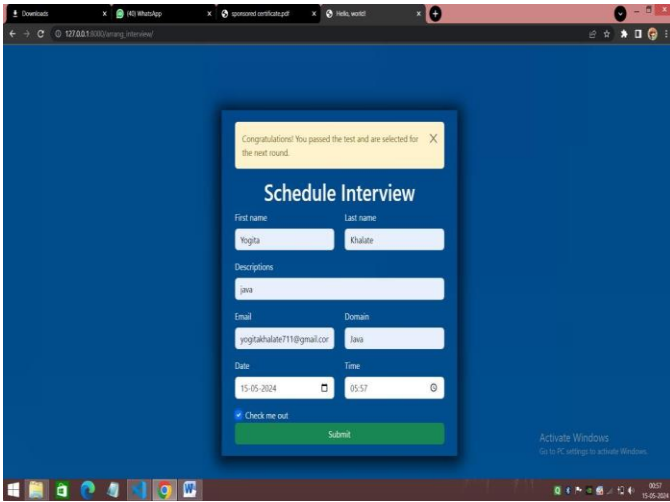
Figure 9 Schedule Interview

Figure 10 Message Box Page

7. Results Analysis

Table 1 Results Analysis

	Existing System	Proposed System
Precision	67.78	78.70
Recall	78.47	80.64
F-Measure	73.51	75.38
Accuracy	83.29	87.26

7.1. Precision

Precision is a crucial metric in evaluating classification models, especially in tasks like news categorization. It measures the accuracy of positive predictions by calculating the proportion of correctly predicted positive instances (true positives) out of all instances predicted as positive (true positives + false positives). In the context of news categorization, precision provides insights into the effectiveness of classifying articles into their respective categories. A high precision score indicates that a significant portion of the articles classified into a category were correctly classified, minimizing misclassification and ensuring the quality and accuracy of the categorization process. The proposed system achieves a higher precision of 78.70% compared to the existing system's 67.78%, meaning that it has a lower rate of misclassifying candidates into incorrect categories. Table 1 Shows the result Analysis.

7.2. Recall

Recall, also referred to as sensitivity, is a key metric used in evaluating classification models, particularly in tasks like news categorization. It quantifies the ability of a system to correctly identify positive instances by measuring the proportion of correctly predicted positive instances (true positives) out of all actual positive instances (true positives + false negatives). In the context of news categorization, recall provides insights into the system's capability to accurately identify articles belonging to specific categories among all articles that genuinely belong to those categories. A high recall score indicates that the system can effectively identify a large portion of relevant articles, minimizing the chances of missing out on important information within those categories. The proposed system achieves a higher recall of 80.64% compared to the existing system's 78.47%, indicating that it captures a greater proportion of relevant data.

7.3. F-Measure

The F-measure serves as a metric to strike a balance between precision and recall in evaluating classification models. It is computed as the harmonic mean of precision and recall, utilizing the formula 2 * (precision * recall) / (precision + recall). A higher F-measure signifies a better equilibrium between the precision of correctly predicted positive instances and the recall of accurately identifying actual positive instances. This metric is particularly useful in scenarios such as news categorization, where both

precision and recall play vital roles in assessing the effectiveness of classification systems. By considering both precision and recall simultaneously, the F-measure provides a comprehensive evaluation of a system's performance, highlighting its ability to achieve both accurate positive predictions and comprehensive identification of actual positive instances. The proposed system achieves a slightly higher F-measure of 74.31% compared to the existing system's 73.11%, indicating improved overall performance in correctly classifying candidates while considering both precision and recall.

7.4. Accuracy

Accuracy measures the overall correctness of the system across all categories. It's calculated as (true positives + true negatives) / total instances. A higher accuracy indicates a higher overall correct classification rate. The proposed system achieves a higher accuracy of 87.26% compared to the existing system's 83.29%, indicating a better overall performance in correctly categorizing and selecting candidates for respective position.
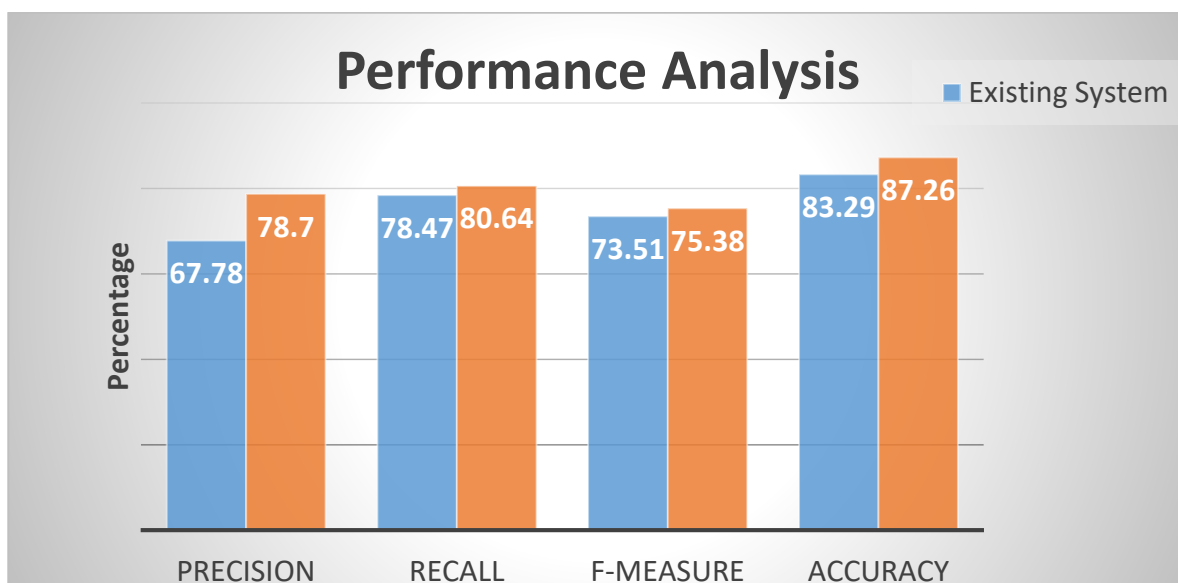

Figure 11 Performance Analysis

8. Future scope

The future scope of our proposed system is for selecting best candidate from number of applications without cheating. User will submit application form for applying for a job. Chatbot will give list of user to HR whenever required. His list displayed based on skills mentioned by HR and skills mention by user. Chatbots can answer candidate queries, provide updates on application status, and ensure continuous engagement, improving the candidate experience. Automation speeds up various stages of the recruitment process, significantly reducing the time required to fill position.

Conclusion

Robotic framework for IT recruitment offers advantages in streamlining the hiring process. Automation reduces the time and effort required for repetitive tasks such as resume screening, parsing. It helps recruiters to focus on more strategic aspects of recruitment process. It can analyze number of applications and match candidates with job profiles by matching skills, domain, and experience. This framework significantly reduces the administrative burden on recruiters, allowing them to focus on strategic aspects of the recruitment process. Candidates experience a more user-friendly and responsive application process, fostering positive impressions of the organization. In a rapidly evolving IT industry, where talent is scarce and in high demand, the robotic framework for IT recruitment is a game- changer, its ability to harness the power of automation and artificial intelligence to create a more efficient and effective recruitment process benefits not only organizations but also job matching applicants. By reducing man-power it speeding hiring

process.

References

[1]. Chaudhari, Y., Jadhav, P., & Gupta, Y. (2022, December). An end to end solution for automated hiring. In 2022 Fourth International Conference on Emerging Research in Electronics, Computer Science and Technology (ICERECT) (pp. 1-6). IEEE.

[2]. V. Narang, J. Sharma and D. Saveetha, "Boost Smart Recruiting and Portfolio Building Platform with AI Bot," 2022 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India, 2022, pp. 1-8, doi: 10.1109/ICCCI54379.2022.9740957.

[3]. Nawaz, N., & Gomes, A. M. (2019). Artificial intelligence chatbots are new recruiters. IJACSA) International Journal of Advanced Computer Science and Applications, 10(9).

[4]. Koivunen, S., Ala-Luopa, S., Olsson, T. et al. The March of Chatbots into Recruitment: Recruiters' Experiences, Expectations, and Design Opportunities. Compute Supported Coop Work 31, 487–516(2022). https://doi.org/10.1007/s10606-022-09429-4.

[5]. Harsha Pariyani,2Anshika Sinha, 3Preeti Bhat, 4Roshni Rote, Prof. N. A. Mulla, AI Based Scrutiny Bot for E- interview Using Natural Language Processing and Emotion Recognition", International Journal of Emerging Technologies and Innovative Research (www.jetir.org|UGCandissn Approved),ISSN:2349-5162,Vol.7, Issue 5, page no. pp65-69, May-2020, Available at : http://www.jetir.org/papers/JETIR20

[6]. Shao, T., Song, C., Zheng, J., Cai, F., & Chen, H. (2023, March 31). Exploring Internal and External Interactions for Semi-Structured Multivariate Attributes in Job-Resume Matching. International Journal of Intelligent Systems. https://doi.org/10.1155/2023/2994779.pdf.

[7]. Tuffaha, M., Pandya, B., & Perello-Marin, M. R. (2022). AI-powered chatbots in recruitment from Indian HR professionals' perspectives: Qualitative study. The journal of contemporary issues in business and government, 28(4), 1971-1989.

[8]. Siswanto, J., Suakanto, S., Andriani, M., Hardiyanti, M., Kusumasari, T.F., 2022. Interview Bot Development with Natural Language Processing and Machine Learning. International Journal of Technology. Volume 13(2), pp. 274-285

[9]. Pramod, D. (2022). Robotic process automation for industry: adoption status, benefits, challenges and research agenda. Benchmarking: an international journal, 29(5), 1562-1586.

[10]. Gusain, T. Singh, S. Pandey, V. Pachourui, R. Singh and A. Kumar, "E-Recruitment using Artificial Intelligence as Preventive Measures," 2023 International Conference on Sustainable Computing and Data Communication Systems (ICSCDS), Erode, India, 2023, pp. 516-522, doi: 10.1109/ICSCDS56580.2023.10105102.

[11]. Wang, J., & Dong, Y. (2020). Measurement of text similarity: a survey. Information, 11(9), 421.

[12]. Pradeep Kumar Roy, Sarabjeet Singh Chowdhary, Rocky Bhatia, "A Machine Learning approach for automation of Resume Recommendation system, Procedia Computer Science, "Volume 167,2020, Pages 2318-2327, ISSN 1877-0509.

[13]. Langer, Markus; and Richard N. Landers (2021). The future of artificial intelligence at work: A review on effects of decision automation and augmentation on workers targeted by algorithms and third-party observers. Computers in Human Behavior, vol. 123. https:// doi. org/ 10. 1016/j.chb. 2021. 106878.

[14]. Charlwood, Andy; and Nigel Guenole (2022). Can HR adapt to the paradoxes of artificial intelligence? Human Resource Management Journal, pp. 1–14. https:// doi. org/ 10. 1111/ 1748- 8583.12433.