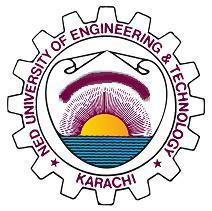
###### UNDERGRADUATE FINAL YEAR PROJECT REPORT

Department of Computer & Information Systems

NED University of Engineering and Technology



**Smart Automated Interviewing System using Gesture Analysis & NLP**

**Group Number: 04**

**Batch: 2019 – 2023**

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Wania Siddiqui CS-19120

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Approved by

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Anita Ali

Assistant Professor

Project Advisor

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**Author’s Declaration**

We declare that we are the sole authors of this project. It is the actual copy of the project that was accepted by our advisor(s) including any necessary revisions. We also grant NED University of Engineering and Technology permission to reproduce and distribute electronic or paper copies of this project.

Signature and Date

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Signature and Date

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##### Statement of Contributions

* **Tooba Nizami CS-19101**

Literature Study

Methodology

* **Wania Siddiqui CS-19120**

Literature Study

Introduction

* **Moiz Ali CS -19087**

Literature Study

Summary

* **Uzair Farooqui CS-19143**

Literature Study

Results

##### Executive Summary

The process of hiring the right candidate for a job is a crucial task for any organization. However, the traditional interview process can be time-consuming and subjective, with a high risk of interviewer bias. Moreover, the assessment of a candidate's non-verbal communication, such as body language and facial expressions, can be challenging and subjective. These factors can result in companies making suboptimal hiring decisions, which can ultimately harm the organization's performance.

To address these issues, there has been a growing interest in developing automated interviewing systems that can assist with the interview process. Such systems utilize various technologies such as Natural Language Processing (NLP), Computer Vision, and Machine Learning to automate certain aspects of the interview process and provide more objective evaluations of candidates' suitability for the job.

NLP, in particular, has been used to analyze the candidate's responses to interview questions and identify important keywords, thereby providing a more objective evaluation of the candidate's responses. Additionally, gesture analysis has been used to monitor the candidate's body language and facial expressions, providing insight into their level of engagement, confidence, and honesty.

The NLP component of the system was developed using machine learning algorithms to analyze the candidate's responses to interview questions. The algorithms were trained on a dataset of interview transcripts to identify important keywords and perform analysis. This allowed the system to provide a more objective evaluation of the candidate's responses. The Gesture Analysis component of the system used computer vision to monitor the candidate's body language and facial expressions. A camera was used to capture the candidate's movements, and the data was processed using computer vision algorithms to identify important gestures and facial expressions. This provided insight into the candidate's level of engagement, confidence, and honesty.

Overall, the Smart Automated Interviewing System offers a promising solution for companies looking to streamline their hiring processes, reduce interviewer bias, and improve the accuracy of candidate evaluations. However, it is important to keep in mind the limitations of the system and to supplement it with additional evaluation methods when necessary.

##### Acknowledgments

I would like to express my most profound appreciation to Ms. Anita Ali, Assistant Professor of the Computer & Information Systems Department for her cooperation as she has been highly supportive of the project. She worked actively to provide us with protected academic time to work on the project.

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##### List of Abbreviations

**NLP** Natural Language Processing

**AI** Artificial Intelligence

**EPBP** Economic Payback Period

##### List of Symbols

##### Text, letter Description automatically generated

##### United Nations Sustainable Development Goals

The Sustainable Development Goals (SDGs) are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. There is a total of 17 SDGs as mentioned below. Check the appropriate SDGs related to the project.

* No Poverty
* Zero Hunger
* Good Health and Well being
* QualityEducation
* Gender Equality
* Clean Water and Sanitation
* Affordable and Clean Energy
* Decent Work and Economic Growth
* Industry, Innovation and Infrastructure
* ReducedInequalities
* Sustainable Cities and Communities
* Responsible Consumption and Production
* Climate Action
* Life Below Water
* Life on Land
* Peace and Justice and Strong Institutions

##### Similarity Index Report

Following students have compiled the final year report on the topic given below for partial fulfillment of the requirement for Bachelor’s degree in **Bachelor’s of Computer & Information Systems Engineering.**

**Project Title Smart Automated Interviewing System using NLP & Gesture Analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No. Student Name** | |  | **Seat Number** | **Signature** |
| **1.** |

1. Tooba Nizami CS-19101
2. Wania Siddiqui CS-19120
3. Moiz Ali CS-19087
4. Uzair Farooqui CS-19143

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Signature and Date

..................................

Anita Ali

#### Chapter 1 Introduction

* 1. **Background Information**

Advances in technology are changing and personalizing the way humans interact with computers, and this is rapidly changing what survey researchers need to consider as they design the next generation of interviewing technologies. Software process automation is a technology that may be viewed as something that has both positive and negative impact. On one hand it can be viewed as a productivity and quality enhancer, while on the other hand, it can be viewed as a mechanism to control, routinize, and de-skill work. These views both differ on different levels but with appropriate design and considerations, we believe that it is possible to enhance the positive elements while reducing the negative ones. In such a busy era, the main aim of the growing technology is to automate each and every thing so that it can result in less utilization of Human resource and more in the usage of robots or any type of smart machine or system.

While researching in this project we are aiming to identify how internet is influencing the recruitment process of an organization.

HR departments receive thousands of Resumes every day and it is not possible for them to go through all of them and shortlist the candidates.This process of judging the candidate using the CV or Resume manually can take a longer time so usually the Recruiters either mention some requirements for the candidate or they also make use of platforms like LinkedIn or Google forms to take a short test but still it cannot help them out to shortlist the candidates. Moreover, it can consume alot of time and also energy. For such purpose, this process of Interviewing a candidate , judging them & shortlisting can be automated by using the modern technology such as Artificial Intelligence i.e. Machine Learning.

The proposed solution for the aforementioned problem is to design and develop a smart system that will conduct interviews in Real-time. The system will manage the entire interview process, conducting interviews, scoring, and shortlisting the candidate for the job.

* 1. **Significance and Motivation**

The main motivation to develop such a model or system which can perform things on its own is Automation. Automating all the tasks is the main goal of advancing technology. Automated interview scheduling empowers the hiring team to instantly schedule interviews online. Eliminating scheduling delays accelerates hiring and reduces the number of candidates who drop out of the interview process while helping the talent acquisition team do more with their time. Automated Interview streamlines talent acquisition teams’ workloads, allowing for greater flexibility, automated administrative functions, and improved efficiency. Whether scheduling phone screens, event interviews, or complex interview days, automated interview scheduling ensures the process is optimized for all participants. Automated interview scheduling helps companies meet top talent faster by eliminating [candidate loss](https://yello.co/blog/real-life-stories-from-candidate-who-ghosted-their-recruiters/) caused by unnecessary back-and-forth emails and phone calls.

This AI-Based Intelligent system will help save the HR department's time by directly interacting with the Humans and judging the Candidate using gesture analysis. A system that can sense when the candidate is confused or nervous or bogus then it will know what and when particular actions and responses are desirable. With the help of this system, a fair analysis of the interviewee's ability can be inferred as it will give a better understanding of one’s areas of expertise and lack. Moreover, the system will shortlist deserving candidates without asking for Human help. The output of this project will help the company select the right employees for the company. By integrating this system into their company, they could easily manage interview processes.

It will make the work of HR Managers easy. This will help them manage all documents related to the interview process easily. Automation can be very effective and efficient and will improve the business process in general. It will also be very convenient on the part of the applicants since they can now apply for a job without commuting. The success of this project will contribute to the knowledge and skills in the field of expertise for Researchers.

* 1. **Aims and Objectives**

The aims and objectives of the project are:

* To design a system that will manage all aspects of the interview process.
* To develop a system that will eliminate paper works in handling interview records.
* To ensure the candidate is the real one through some authentication process.
* To design an intelligent system that predicts the eligibility of the candidate and whether the candidate is suitable for the respective position or not.
* The system will throw questions from the question bank in random order, at this point the system will ensure that the question's answer would not be Yes/No. Then the recorded answers of the candidate will be converted into text and then processed through NLP techniques.
* While the candidate is giving the answers, the system monitors various gestures of the candidate. Some gesture analysis techniques can be applied to determine his confidence level. This score is also added to compute the total score obtained by the candidate.
* The response of the candidate to every question will be processed using algorithms to accept features from the response, along with the features of the question that the response is pertaining to. The correctness of the answer will be scored relatively and finally required a number of candidates having high scores can be called by the HR department for the final interview.
  1. **Methodology**

The proposed solution to this problem will be tackled with the help of Artificial Intelligence. It will be purely based on Machine learning. We will be solving the problem of analyzing the sentiments, answers, and responses of the candidate using Natural Language Processing techniques. A model will be developed that throws questions to the candidate, the candidate will answer the question and the text will be converted from voice to text using Machine learning. The text will be analyzed by an NLP model developed by our team. Answers to the questions will be matched with the answers learned by the model and the score will be calculated. The calculated score will decide if the candidate is suitable to be shortlisted or not. The system will analyze the Movement of the candidate by Gesture Analysis to check the In-confidence level of the candidate whether he/she is confident & suitable enough for the position or not. The results of the Gesture Analysis will be included as an assessment point.

The process of gesture analysis will be implemented through Python using a library called “MediaPipe”. It helps in the effective tracking of gestures. After the frames of pictures have been collected, they will be processed through basic Image processing tools to calculate the score for the parameters of in-confidence level set.

* 1. **Report Outline**

The fifth section of the chapter one should be “Report Outline”. It should include the scope of the project and explain the general outline of the report by highlighting the content that is covered in different chapters and sections.

Kindly include more sections in the Introduction chapter if you prefer.

#### Chapter 2 Literature Review

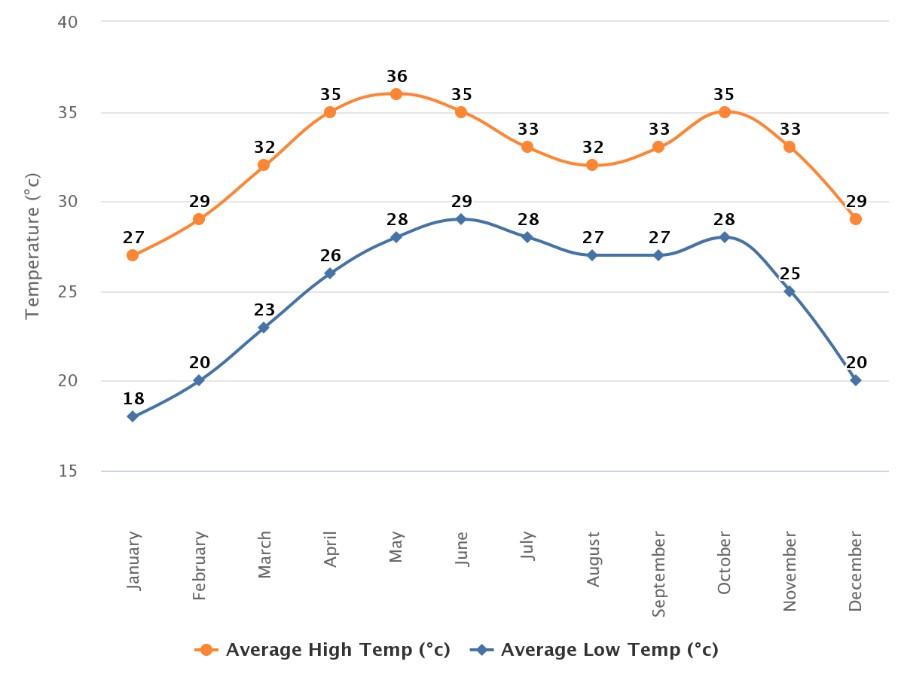
* 1. **Introduction**

Except for the Introduction chapter (first chapter) and the Conclusion chapter (last chapter), all other chapters should have first section titled “Introduction” and last section titled “Summary/Conclusions”. In Introduction sections, discuss the content of chapters such that the readers will have an idea about what is discussed in the chapters. This allows the readers to know in advance if the chapter is relevant to their interests. On the other hand, the Summary sections discuss what has been achieved in the chapters. Write the Summary sections by keeping in mind that many readers do not have time to read the complete chapters; therefore, they only read Summary sections to get an overview. Consequently, include the most important achievements and aspects in these sections and use past tense to write Summary sections.

The goal of this chapter is you discuss how your work is different from the work already done in the field. You should present a critical review on the past work on your topic. This chapter will in return help students to gather updated knowledge on the project and this will enable them to understand the limitations of previous work done on your topic.

* 1. **[Title of the Section]**

A sample graph is shown in the [Figure 1](#_heading=h.1y810tw). Always use the “Insert Caption” option to insert the figure label and numbering automatically. This will also automatically update them in the List of Figures. Captions of figures should be given on the bottom of the figures. To refer to a figure in the text go to References in the Ribbon, then click on Cross-reference, then select Figure in Reference type, then select Only label and number in Insert reference to.



**Figure 1: Trend of Monthly Average High and Low Temperatures in Karachi (Shepherd, 1956)**

* 1. **[Title of the Section]**

A sample table is shown in the [Table 1.](#_heading=h.2xcytpi) Always use the “Insert Caption” option to insert the figure label and numbering automatically. This will also automatically update them in the List of Figures. Captions of tables should be given on the top of the tables. To refer to a table in the text go to References in the Ribbon, then click on Cross-reference, then select Table in Reference type, then select Only label and number in Insert reference to.

**Table 1: Residual Stresses for a Plate**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Orientation** | 𝝈�(𝑴𝑷𝒂) | 𝝈�(𝑴𝑷𝒂) | 𝝉��(𝑴𝑷𝒂) | 𝝉��(𝑴𝑷𝒂) | 𝝉��(𝑴𝑷𝒂) |
| 0° | -0.282 | -0.143 | 0 | 0 | 0 |
| 90° | 0.282 | 0.143 | 0 | 0 | 0 |

* 1. **More Sections**

Include sections as appropriate to your literature review.

* 1. **Summary**

Last section of each chapter should be Summary or Conclusion.

#### Chapter 3 [Name of the Chapter]

**3.1 Introduction**

Include more chapters as appropriate to your project. All chapters should start from a new page. The middle chapters should discuss your work on the project. Some famous headings for these chapters are Design and Calculations, Modeling and Simulations, Fabrication Work, Data Acquisition and Analysis, Comparison of Methods, Results, Discussion/Interpretation of Results, etc.

#### Chapter 4 [Name of the Chapter]

**4.1 Introduction**

More chapters.

#### Chapter 5 Conclusions

* 1. **Summary**

The report describes a Smart Automated Interviewing System that utilizes Natural Language Processing (NLP) and Gesture Analysis to assist with conducting job interviews. The system is designed to automate certain aspects of the interview process, and evaluating the candidate's non-verbal communication, thereby reducing the workload on the interviewer.

Some of the aims and objectives of our project are listed below:

**AIMS:**

* To develop an automated interviewing system that can assist with the interview process by automating certain aspects of the process and providing more objective evaluations of candidates' suitability for the job.
* To improve the accuracy of candidate evaluations and reduce interviewer bias.
* To streamline the hiring process for companies and reduce the time and resources required for the interview process.
* To explore the potential of natural language processing and gesture analysis techniques in improving the efficiency and effectiveness of the interview process.

**OBJECTIVES:**

* To develop a natural language processing component that can analyze the candidate's responses to interview questions and identify important keywords and analyze it.
* To develop a gesture analysis component that can monitor the candidate's body language and facial expressions to provide insight into their level of engagement, confidence, and honesty.
* To integrate the natural language processing and gesture analysis components into a single system.
* To evaluate the performance of the system through a user study and compare its effectiveness to traditional interviewing processes.
* To identify areas for future improvement and refinement of the system.

The work has accomplished through a chain of different steps and processes that includes Literature Study that makes ground for the project’s applications, researching for the methodology that gives proper efficiency, the proper implementation of the project through a series of steps and the integration of all the components into a single system. These all individual steps have leads to the accomplishment of the project.

* 1. **Recommendations for Future Work**

Some of the recommendations for future work are listed below:

1. Integration with other technologies: The system could be integrated with other technologies such as virtual reality or augmented reality to provide a more immersive interviewing experience for both the candidate and the interviewer. This could help to improve the overall effectiveness of the system and provide a more engaging and interactive experience for users.

2. Incorporation of advanced machine learning algorithms: The development of more advanced machine learning algorithms for NLP analysis could improve the accuracy of sentiment analysis and allow the system to identify more complex patterns in the candidate's responses.

3. Exploration of advanced computer vision techniques: Advanced computer vision techniques could be explored to improve the accuracy of gesture analysis, such as using more advanced facial recognition algorithms or incorporating more advanced body language analysis techniques.

4. Expansion of the system to support multiple languages: The system could be expanded to support multiple languages to allow companies to use the system for interviews conducted in different languages.

5. Development of a mobile app: A mobile app could be developed to allow candidates to participate in interviews remotely, increasing accessibility and reducing the need for in-person interviews.

6. Integration with HR analytics: Integration with HR analytics could allow for the system to provide valuable insights into hiring trends and candidate performance, helping companies make more informed hiring decisions.

##### Appendix A [Title of Appendix]

Include appendices, if applicable. Appendices should include the information that is not the primary part of the main body of the project report. This means that if this information is removed from the main body, it would not negatively affect the flow of ideas in the main body of the report. For example, it may include long computer programming codes while keeping a flow chart of the code in the main body of the report. It may also include lengthy numerical data while keeping their graphs in the main body of the report.

If the project report has only one appendix, then the label of this chapter should be “Appendix” (not “Appendix A”). To cite an appendix in the text, write full title of the appendix that is “Appendix A”, “Appendix B”, etc. Each appendix should start from a new page and should also include a short description of what is included in that appendix.

#### References

Shepherd, D. G. (1956). Performance of one-row tube coils with thin-plate fins, low velocity forced convection. *Heating, Piping Air Cond, 28*, 137-144.

##### Glossary [Optional]

|  |  |  |
| --- | --- | --- |
| **Term** | **Definition** | [Page at which it  first appeared] |
| **Azimuth** *angle between North, measured clockwise around the* Pg. 1 | | |

*observer's horizon and sun*

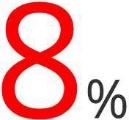
**Zenith** *an imaginary point directly above the observer/system, complement of altitude angle*

Pg. 5

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