**RIPHAH INTERNATIONAL UNIVERSITY**

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**Faculty of Computing**

**FINAL YEAR PROJECT PROPOSAL & PLAN**

**Multi-Purpose AI Password Analysis Tool**

**Project Team**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
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**Sir Osamah Ahmed**

**Multi-Purpose AI Password Analysis Tool**

**Change Record**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author(s)** | **Version** | **Date** | **Notes** | **Supervisor’s Signature** |
|  | 1.0 |  | Original Draft |  |
|  |  |  | Changes Based on Feedback from Supervisor |  |
|  |  |  | Changes Based on Feedback from Faculty |  |
|  |  |  | Added Project Plan |  |
|  |  |  | Changes Based on Feedback from Supervisor |  |
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**Project Proposal**

**Project Title:** Multi-Purpose AI Password Analysis Tool

**Background**

Traditional password cracking tools have relied on brute force techniques or precomputed dictionaries to decipher passwords. While these methods have been effective to some extent, they suffer from several limitations and challenges.

1. **Limited Efficiency**: Brute force attacks iterate through all possible combinations of characters, making them time-consuming and resource-intensive, especially for complex passwords.
2. **Dependence on Dictionaries**: Dictionary attacks rely on precompiled lists of commonly used passwords or words found in dictionaries. However, these lists may not encompass all possible variations, especially when users employ complex or unique passwords.
3. **Lack of Adaptability**: Traditional tools often struggle with adaptive password generation techniques, such as adding special characters or changing letter cases, making them less effective against modern password practices.
4. **Inability to Detect Breached Credentials**: Many password cracking tools do not have built-in mechanisms to cross-reference passwords with known breaches, leaving users unaware if their passwords have already been compromised.
5. **Scalability Issues**: As passwords become longer and more complex to enhance security, traditional methods face scalability challenges in terms of processing power and memory requirements.

**Introduction**  
In today's world, where everything is becoming digital and online threats are on the rise, having strong password security is absolutely crucial. That's where the AI Multipurpose Password Analysis Tool comes in. It's a game-changing software that's here to revolutionize how we manage passwords. By combining cutting-edge artificial intelligence with traditional password analysis tools, this tool offers a complete solution for keeping our digital accounts safe. Whether it's cracking passwords or assessing password’s strength, this tool covers multiple aspects of password security. And it doesn't stop there - it seamlessly works with popular tools like Hashcat and John the Ripper, making it even more powerful. So, as we step into the future of password management, the AI Multipurpose Password Analysis Tool is leading the way, providing both analysis and cracking abilities to protect our sensitive information from the ever-evolving threats online.

**Opportunities and Stake Holders**

**Opportunities**

* **Enhanced Security Assessments:** Businesses and individuals can leverage the tool for penetration testing and vulnerability assessments, identifying potential weaknesses in their password security policies and practices.
* **AI-driven Offensive and Defensive Capabilities:** Utilizing AI for both offensive (password cracking) and defensive (password strength assessment) purposes provides a comprehensive approach to password security management.

**Stake Holders**

* **Businesses:** Companies aiming to improve their overall cybersecurity posture by identifying and mitigating password-related vulnerabilities.
* **Security Professionals:** Penetration testers and security consultants who can use the tool for vulnerability assessments and ethical hacking activities.
* **Law Enforcement:** Agencies might leverage the tool for lawful investigations adhering to court orders and legal guidelines.

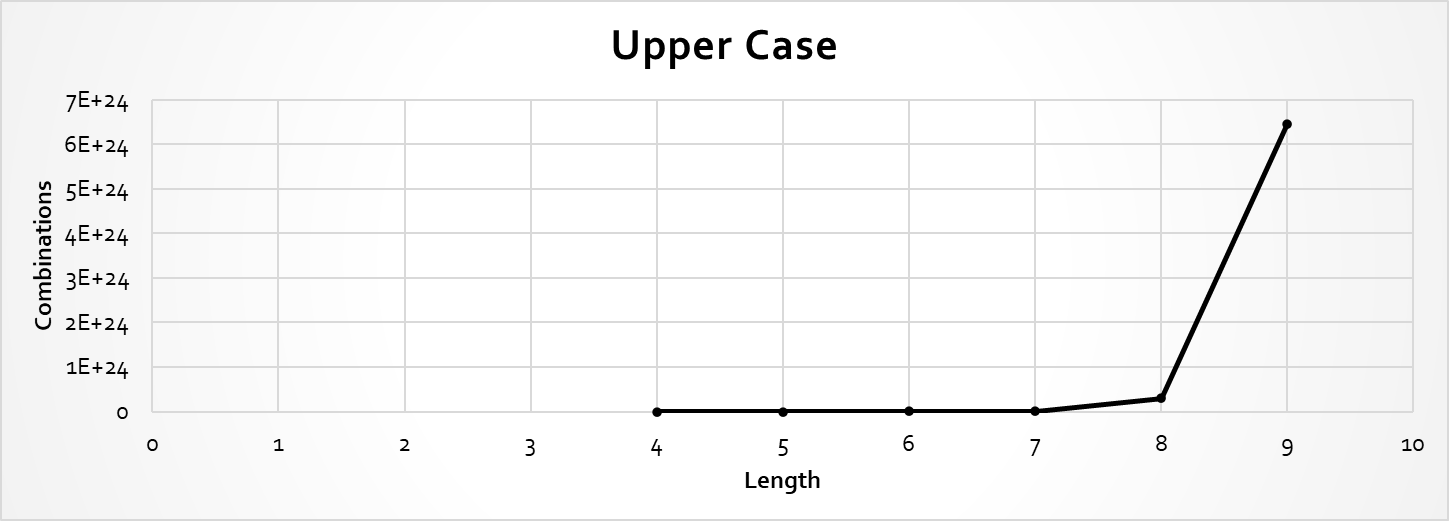
**Existing Systems**

1. **John the Ripper:**
   * **Limitations:**
     + Relies on traditional methods of password cracking such as dictionary attacks, brute-force attacks, and rainbow tables.
     + While powerful, it may not effectively adapt to evolving password patterns and behaviors without continuous updates and modifications.
   * **Problems:**
     + Lack of advanced AI integration for targeted password list generation based on learned patterns.
     + Limited defensive capabilities in analyzing password strength beyond basic dictionary checks.
2. **Brutus:**
   * **Limitations:**
     + Primarily designed for online password cracking through network protocols like HTTP, FTP, SMB, etc.
     + May lack advanced AI-driven capabilities for generating targeted password lists.
   * **Problems:**
     + Limited applicability for offline password analysis and cracking scenarios.
     + May not integrate well with the defensive aspects of the proposed tool, such as analyzing password strength and checking for breached credentials.
3. **Wfuzz:**
   * **Limitations:**
     + Primarily focuses on web application security testing, including fuzzing and brute-forcing directories and files.
     + May lack specialized features for password cracking and analysis.
   * **Problems:**
     + Not specifically tailored for password analysis and cracking tasks, thus requiring significant adaptation to fit into the proposed project's scope.
     + Limited or no integration with AI-driven password analysis and cracking techniques.

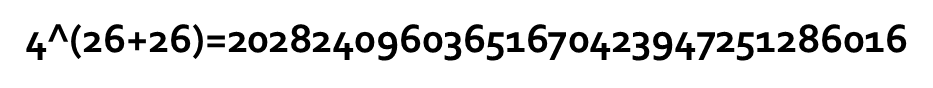
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Tool | John the Ripper | RainbowCrack | OphCrack | L0phtCrack | Aircrack-ng |
| **Type** | Password Cracker | Password Cracker | Password Cracker | Password Cracker | Wi-Fi Network Security Tool |
| **Supported Platforms** | Windows, Linux, macOS | Windows, Linux | Windows, Linux | Windows | Linux, macOS |
| **Password Hashes Supported** | Various (Unix, Windows, etc.) | LM, NTLM, MD5, SHA1, SHA256, SHA512 | LM, NTLM | LM, NTLM | WEP, WPA, WPA2 |
| **Attack Methods** | Dictionary, Brute Force, Hybrid | Precomputed Hash Tables | Rainbow Tables, Brute Force | Dictionary, Brute Force | Dictionary, Brute Force, WPS PIN |
| **Speed** | Fast | Depends on Rainbow Table size | Moderate | Fast | Depends on hardware and complexity of the password |
| **User Interface** | Command Line | Command Line | GUI | GUI | Command Line |
| **License** | Open Source | Freeware | Open Source | Commercial | Open Source |
| **Usage** | Penetration Testing, Password Auditing | Password Cracking | Password Recovery | Password Cracking | Wi-Fi Network Security Testi |

**Problem Statement**

* With increasing password complexity requirements, brute-force attacks become significantly slower and less efficient.



* Users often employ longer and more complex passwords (e.g., 8+ characters, combination of uppercase, lowercase, symbols) making traditional brute-force methods impractical.



**Uppercase and Lowercase length of 4**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Length | Upper Case | Upper + Lower Case | Upper + Lower + Numeric | Upper + Lower + Numeric + Special Char |
| 4 | 4.5036E+15 | 2.02824E+31 | 2.12676E+37 | 3.92319E+56 |
| 5 | 1.49012E+18 | 2.22045E+36 | 2.1684E+43 | 5.04871E+65 |
| 6 | 1.70582E+20 | 2.90981E+40 | 1.75945E+48 | 1.40029E+73 |
| 7 | 9.38748E+21 | 8.81248E+43 | 2.48931E+52 | 2.74926E+79 |
| 8 | 3.02231E+23 | 9.13439E+46 | 9.80797E+55 | 7.77068E+84 |
| 9 | 6.46108E+24 | 4.17456E+49 | 1.45558E+59 | 4.998E+89 |

**Proposed Solution**

* Our AI-powered tool leverages advanced algorithms and Human like passwords data to:
  + **Focus cracking efforts on statistically probable password patterns:** This reduces the search space and accelerates the cracking process compared to traditional brute-force methods.
  + **Analyze password strength based on complexity metrics and AI-driven pattern recognition.** This identifies potential weaknesses in complex passwords, aiding in targeted cracking attempts.

**Objectives**

* Focus cracking efforts on statistically probable password patterns.
* Analyze password strength based on complexity metrics and AI-driven pattern recognition.
* Reduced cracking time.
* Improved vulnerability assessment.

**Project Scope**

* **Defensive capabilities:**
  + **Password strength assessment:** Analyze password complexity, identify dictionary words, and check for patterns using AI.

**Optional**

* + **Breach checking:** Integrate with online databases to verify if entered passwords and email IDs have been exposed in known data breaches.
* **Offensive capabilities (for Ethical Purposes only):**
  + **AI-powered password cracking:** Utilize correlation of password data and advanced algorithms to efficiently crack passwords within a specified scope and with proper authorization.

**Methodology**

* **AI Model Development:**
  + Utilize a deep learning framework (e.g., TensorFlow, PyTorch) to train an AI model on password datasets.
  + This will enable the model to identify patterns and weaknesses specific to different password landscapes.
* **Tool Development:**
  + Develop a user-friendly interface for both offensive and defensive functionalities.
  + Integrate libraries/APIs for password hashing, breach checking with online databases, and password cracking.

**Evaluation Plan:**

Aligned with the objectives of our project, we will conduct a comprehensive assessment of the AI Multipurpose Password Analysis Tool's performance using diverse password datasets sourced from various sources, including real-world breaches, password dictionaries, and synthetic data generation. This dataset will serve as the cornerstone for evaluating the tool's effectiveness in analyzing password strength, detecting anomalies, and facilitating password cracking across different scenarios.

To quantitatively measure the tool's accuracy and performance, we will employ several metrics, including precision, recall, accuracy, and F1 score. These metrics will provide a systematic framework for assessing the tool's classification and anomaly detection capabilities. Additionally, we will utilize performance benchmarks established by existing password analysis tools such as Hashcat and John the Ripper to benchmark our tool's performance against industry standards.

Qualitative evaluation methods will also be employed, including user feedback sessions and usability testing. These sessions will gather insights from cybersecurity professionals, IT administrators, and end-users regarding the tool's functionality, effectiveness, and ease of use. Expert opinions from cybersecurity experts will further inform the evaluation process, providing valuable insights into emerging trends and best practices in password security.

By integrating both quantitative and qualitative evaluation approaches, we aim to fine-tune and validate the AI Multipurpose Password Analysis Tool, ensuring its reliability and effectiveness in enhancing password security in diverse digital environments. This evaluation process will serve as a critical step in validating the tool's capabilities and guiding future enhancements and refinements.

**List of Faculty Proposed Changes**

**Project Title**

**Supervisor’s Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| --- | --- | --- |
| **Proposed Change** | **Proposed By** | **Supervisor’s Decision** |
| Please study “PassGAN, Hashcat and RockYou 2021! These are commonly used password cracking tools. How will we validate the proposed idea.  Mention the datasets that we are going to use in this project.  Reduce the scope of the project. | Dr. Jawaid Iqbal |  |
| Idea is good. Great Presentation skills. Best of luck. | Haseeb Ahmed |  |
| Excellent Idea, Excellent Presentation and explanation. | Awais Nawaz |  |
| Good Idea. Good presentation delivery.  Just need to dig in more to wind up in time. | Tajjamul Shahzad |  |
| Draw comparison between your work and existing systems. Clearly mention your contributions.  What will be the procedure for validation? | Ihtisham Ullah |  |
| Good Idea. Limit your password length. | Engr. Muhammad Ahmed Nawaz |  |
|  |  |  |

**Project Plan**

1. **Title Page:**
   * **Project Title:** **Multi-Purpose AI Password Analysis Tool**
   * **Author:** Osama Khalid, Salman Ali & S.M. Zeeshan Khan.
   * **University Name:** Riphah International University
   * **Department:** Department of Cyber Security
   * **Date:** 15th March, 2024
2. **Abstract:**
   * **Summary of the Project:** This project proposes the development of a multi-purpose AI password analysis tool offering both offensive and defensive capabilities. It leverages AI to analyze and crack passwords, assess their security strength, and identify breached credentials. This tool empowers users to test the resilience of their own passwords and proactively identify vulnerabilities.
3. **Acknowledgments:**

We would like to express our sincere gratitude to the following individuals whose guidance and support were instrumental in the successful completion of this project:

* **Project Supervisor:** We are particularly grateful to our project supervisor, **Mr. Osama Ahmad**, for his invaluable expertise, insightful feedback, and unwavering encouragement throughout the entire project development process. His dedication and support played a pivotal role in shaping the direction and success of our work.
* **Faculty Advisors:** We extend our sincere thanks to our faculty advisors, **Dr. Muhammad Mansoor Alam**, whose passion for AI inspired us to pursue this project, and **Dr. Jawaid Iqbal**, whose knowledge and guidance were invaluable throughout the research phase.
* **Technical Support Staff:** We appreciate the assistance provided by **Mr. Haseeb Ahmed**, **Mr. Ihtesham Ullah**, and **Mr. Tajamul Hussain**. Their technical expertise and willingness to help were crucial in overcoming technical challenges.
* **Project Convener:** We acknowledge the leadership of **Mr. Muhammad Ahmad Nawaz** as the project convener, whose guidance ensured the project's smooth execution within the academic framework.
* **Colleagues and Friends:** Finally, we would like to thank our colleagues, **Mr. Osama Raza** and **Mr. Awais Nawaz**, for their encouragement, collaboration, and support throughout the course of this project. Their positive spirit and willingness to assist contributed significantly to our progress

1. **Table of Contents:**
   * **Introduction**
     + 1.1 Background and Context
     + 1.2 Problem Statement
     + 1.3 Objectives and Scope
   * **Literature Review**
   * **Methodology**
     + 3.1 Research Design
     + 3.2 Tools and Technologies
   * **System Design**
     + 4.1 Architecture and Design
   * **Implementation**
     + 5.1 Implementation Details
   * **Testing and Evaluation**
     + 6.1 Testing Methods
     + 6.2 Results and Evaluation
   * **Results and Discussion**
     + 7.1 Presentation of Results
     + 7.2 Discussion of Findings
   * **Conclusion**
     + 8.1 Summary
     + 8.2 Achievements and Limitations
   * **Future Work**
   * **References**
   * **Appendices**
2. **Introduction:**
   * **Background and Context:** Password cracking tools are essential for cybersecurity professionals and researchers to assess the strength of passwords and identify vulnerabilities in systems. They aid in penetration testing, forensic analysis, and recovery of lost passwords, crucial for maintaining network integrity and protecting against cyber threats but because of the users employ complex passwords, traditional brute-force methods are impractical.
   * **Problem Statement:** With increasing password complexity requirement, brute-force attacks become significantly slower and less efficient. Employment of complex password makes traditional brute-force attacking methods impractical.
   * **Objectives and Scope:**
     + Focus cracking efforts on statistically probable password patterns.
     + Analyze password strength based on complexity metrics and AI-driven pattern recognition.
     + Reduced cracking time.
     + Improved vulnerability assessment.

**Scope:**

* **Defensive capabilities:**
  + **Password strength assessment:** Analyze password complexity, identify dictionary words, and check for patterns using AI.

**Optional**

* + **Breach checking:** Integrate with online databases to verify if entered passwords and email addresses have been exposed in known data breaches.
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* **Tool Development:**
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  + Integrate libraries/APIs for password hashing, breach checking with online databases, and password cracking.
  + **Tools and Technologies:**
    - **AI Model Development:**
      1. Utilize a deep learning framework (e.g., TensorFlow, PyTorch) to train an AI model on password datasets.
      2. This will enable the model to identify patterns and weaknesses specific to different password landscapes.
    - **Tool Development:**
      1. Develop a user-friendly interface for both offensive and defensive functionalities.
      2. Integrate libraries/APIs for password hashing, breach checking with online databases, and password cracking.

1. **System Design:**
   * **Architecture and Design:** Illustrate the architectural framework of your machine learning-based cyber security system. Utilize diagrams or flowcharts to enhance comprehension.
2. **Implementation:**
   * **Implementation Details:** Provide detailed insights into how machine learning algorithms were integrated into the project for effective anomaly detection. Include relevant code snippets or algorithms where applicable.
3. **Testing and Evaluation:**
   * **Testing Methods:** Detail the methods used to evaluate the effectiveness of the machine learning model in detecting anomalies.
   * **Results and Evaluation:** Present the results of testing and critically evaluate the performance of your cyber security system.
4. **Results and Discussion:**
   * **Presentation of Results:** Showcase the outcomes of your project, highlighting successful instances of anomaly detection.
   * **Discussion of Findings:** Analyze and interpret the results, discussing their implications and significance in the broader context of cyber security.
5. **Conclusion:**
   * **Summary:** Summarize the key findings and contributions of the project.
   * **Achievements and Limitations:** Highlight the accomplishments of the project and acknowledge any inherent limitations.
6. **Future Work:**
   * **Suggestions for Future Enhancements:** Provide recommendations for future research or improvements to advance the capabilities of your machine learning-based cyber security system.
7. **References:**
   * **Citations:** List all the sources referenced in your report, adhering to a specific citation style as per the guidelines of your university.
8. **Appendices:**
   * **Additional Material:** Include supplementary materials, such as code snippets, datasets, or additional information supporting the main content of the report.
9. **Formatting Guidelines:**
   * **University-Specific Guidelines:** Adhere strictly to your university's formatting requirements, including font size, margins, line spacing, and citation style.

# Roles & Responsibility Matrix:

The purpose of roles & responsibility matrix is to identify who will do what.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WBS #** | **WBS Deliverable** | **Activity #** | **Activity to Complete the Deliverable** | **Duration**  **(# of Days)** | **Responsible Team Member(s) & Role(s)** |
| 1 | Phase 1: Develop and Train the AI Model | 1.1 | Research and select appropriate AI algorithms for password analysis. |  | Osama Khalid  Zeeshan Khan  Salman Ali |
|  |  | 1.2 | Acquire or prepare relevant password datasets for training. |  |  |
|  |  | 1.3 | Train and optimize the chosen AI model with the selected datasets. |  |  |
| 2 | Phase 2: Implement Core Functionalities | 2.1 | Design and develop functionalities for password strength analysis. |  | Osama Khalid  Zeeshan Khan  Salman Ali |
|  |  | 2.2 | Integrate password breach checking with online databases (securely). |  |  |
|  |  | 2.3 | (Optional) Develop functionalities for automated password cracking (ethical considerations apply). |  |  |
| 3 | Phase 3: Design and Develop User Interface | 3.1 | Design a user-friendly interface for both offensive (optional) and defensive functionalities. |  | Osama Khalid  Zeeshan Khan |
|  |  | 3.2 | Integrate the trained AI model and core functionalities into the user interface. |  |  |
| 4 | Phase 4: Testing and Refinement | 4.1 | Conduct thorough testing of all functionalities with various password scenarios. |  | Osama Khalid  Zeeshan Khan  Salman Ali |
|  |  | 4.2 | Refine the AI model, user interface, and functionalities based on testing results. |  |  |
|  |  | 4.3 | Document user manuals and instructions for the completed tool. |  |  |
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**Approval**

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| **Project Supervisor** | |
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| **Project Coordinator** | |
| **Comments\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** | |
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