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# Research Paper on Password Strength Checker Tool Using Python

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## Abstract

With the exponential growth of digital platforms, password-based authentication remains a primary method for securing user access. Weak passwords pose a significant threat, enabling unauthorized access and potential data breaches. This research presents the development of a simple yet effective Password Strength Checker tool using Python. The tool evaluates password robustness by assessing key security criteria such as length, numeric inclusion, uppercase and lowercase characters, and special symbols. The objective is to enhance user awareness and promote the creation of stronger, more secure passwords. This paper outlines the motivation, development methodology, implementation, and evaluation of the tool, along with its ethical implications and potential real-world applications.

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## Problem Statement & Objective

**Problem Statement:** Weak and easily guessable passwords are a leading cause of security breaches. Despite awareness campaigns, users often create insecure passwords due to lack of knowledge or convenience.

**Objective:** To develop a Python-based tool that can assess and provide immediate feedback on password strength based on established security parameters, thereby promoting better cybersecurity hygiene among users.

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## Literature Review

Numerous studies underscore the importance of strong passwords in cybersecurity. Florencio and Herley (2007) highlighted user tendencies toward weaker passwords. Bonneau (2012) compared password-based authentication with biometric and token systems, affirming passwords' continued relevance. Guidelines from NIST (2017) stress the importance of complexity and entropy in password formation. Tools like zxcvbn by Dropbox introduced pattern-based strength estimation. However, most existing solutions are either too complex or not user-friendly for non-technical audiences. Our tool addresses this gap by providing a simple, user-centric application.

## Research Methodology

The methodology adopted includes:

1. Requirement gathering from existing password guidelines (e.g., NIST).
2. Designing a set of five evaluation criteria:
    - Minimum 8 characters
    - Inclusion of at least one digit
    - Use of uppercase and lowercase letters
    - Presence of special characters
3. Implementing the logic using regular expressions in Python.
4. Testing the tool with varied sample passwords.
5. Analyzing feedback and refining scoring logic.

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## Tool Implementation

The Password Strength Checker was developed using Python 3. It uses the re module to match patterns corresponding to strength criteria. Each criterion met contributes to an overall strength score, which then maps to qualitative ratings like "Weak," "Moderate," or "Strong."

**Code Snippet:**

```
import re


def check_password_strength(password):
    strength = 0
    remarks = ""
    length_error = len(password) < 8
    digit_error = re.search(r"\d", password) is None
    uppercase_error = re.search(r"[A-Z]", password) is None
    lowercase_error = re.search(r"[a-z]", password) is None
    symbol_error = re.search(r"[ !#$%&'()*+,-./[\\]^_`{|}~\"]", password) is None
    if not length_error: strength += 1
    if not digit_error: strength += 1
    if not uppercase_error: strength += 1
    if not lowercase_error: strength += 1
    if not symbol_error: strength += 1

    if strength == 5: remarks = "Very Strong"
    elif strength >= 4: remarks = "Strong"
    elif strength >= 3: remarks = "Moderate"
    elif strength == 2: remarks = "Weak"
    else: remarks = "Very Weak"

    return remarks
```

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**Results & Observations**

The tool was tested with a variety of passwords:

- "12345" → Very Weak
- "Pass123" → Weak
- "Password1!" → Strong
- "Aa1!aa1!" → Very Strong

The results aligned well with expected outcomes based on standard password policies. The tool successfully identified weaknesses and provided actionable feedback.

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**Ethical Impact & Market Relevance**

Ethically, promoting strong passwords contributes to a safer digital environment. The tool can be integrated into websites or applications to guide users during password creation, thus reducing security risks. Its simplicity ensures accessibility, making it relevant for education, small businesses, and developers.

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## Future Scope

- Integration with breach databases (e.g., HaveIBeenPwned) to check if a password has been compromised.
- Real-time web interface using Flask or Django.
- Multi-language support.
- AI-based analysis for personalized password suggestions.
- API development for third-party integration.

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