**Develop a Tool that Generates Secure, Random Password**

**Based on User’s Criteria**

**A Mini Project Report**

**Submitted by**

**NAME: POONTAMILSELVAN P**

**ROLL NO: 22CDR068**

**NAME: RAMPRASANTH S**

**ROLL NO: 22CDR082**

**NAME: SHOBAN KUMAR K C**

**ROLL NO: 22CDR093**

**NAME: VIJAYAKUMAR K**

**ROLL NO: 22CDL127**

***in partial fulfillment of the requirements***

***for the award of the degree***

***of***

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**IN**

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**KONGU ENGINEERING COLLEGE**

**(Autonomous)**

**PERUNDURAI ERODE-638060**

**JANUARY 2024**

**BONAFIDE CERTIFICATE**

This is to certify that the Project Report entitled **Develop a Tool that Generates Secure,**

**Random Password Based on User’s Criteria** is the bonafide record of project work done by **POONTAMILSELVAN P(Register no: 22CDR068), RAMPRASANTH S(Register no: 22CDR082), SHOBAN KUMAR K C(Register no: 22CDR093) VIJAYAKUMAR K(Register no: 22CDL127)** in partial fulfillment of the requirements for the award of the Degree of Bachelor of Engineering in **Computer Science and Design** of Anna University, Chennai during the year 2023-2024.

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**Teamwork Plan & Execution**

|  |  |  |  |
| --- | --- | --- | --- |
| **Team Member Name** | **Work Planned** | **Work Completed** | **Remarks** |
| POONTAMILSELVAN P |  |  |  |
| RAMPRASANTH S |  |  |  |
| SHOBAN KUMAR K C |  |  |  |
| VIJAYAKUMAR K |  |  |  |

Team Member 1 Sign Team Member 2 Sign

Team Member 3 Sign Team Member 4 Sign

**CHAPTER 1**

**ABSTRACT AND INTRODUCTION**

* 1. **ABSTRACT**

The Java program, "PasswordGenerator," is designed to generate secure random passwords based on user-defined criteria. It utilizes a Secure Random class to ensure a high degree of randomness in password generation. The program prompts users to input the desired password length and select options for including lowercase and uppercase letters, digits, and symbols. It constructs a character pool based on the user's choices, combining selected character sets into a single pool. To generate the password, the program uses the established character pool and randomly selects characters from it to form the password of the specified length. It verifies that a valid character pool exists before generating the password, ensuring that at least one character set is selected to prevent an empty pool. The generated password is displayed as output, providing users with a secure, randomized combination of characters, including the selected lowercase and uppercase letters, digits, and symbols. The program allows users to create diverse and robust passwords tailored to their specific security needs.

* 1. **INTRODUCTION**

The "PasswordGenerator" Java program serves as a robust tool enabling users to create highly secure and custom-generated passwords. This application is designed to address the necessity for strong and varied passwords across digital platforms. By offering a user-friendly interface, it empowers individuals to craft passwords based on their preferences for length and character types. The program's functionality lies in its ability to generate passwords incorporating lowercase and uppercase letters, digits, and symbols, enhancing their complexity and resilience against unauthorized access. Utilizing a Secure Random class ensures a high level of randomness, guaranteeing the password's unpredictability.By producing unique combinations of characters based on user-defined parameters, it aids in fortifying digital accounts and enhancing overall cybersecurity measures.

**CHAPTER 2**

**LITERATURE SURVEY**

The landscape of password generation tools encompasses various approaches and technologies aiming to bolster digital security. Traditional methods often involve manual creation or simplistic algorithms, lacking the sophistication required to combat modern security threats. However, recent advancements have led to the development of specialized programs like the "PasswordGenerator" in Java.

Literature surrounding password security emphasizes the critical role of randomness and complexity in thwarting unauthorized access. Studies by Bonneau and Herley et al. highlight the significance of unique, complex passwords in mitigating risks associated with data breaches and brute force attacks. These studies advocate for tailored password creation tools that accommodate user preferences while ensuring robustness against sophisticated hacking techniques.

Additionally, research by Komanduri et al. delves into user behaviour and the challenges of crafting memorable yet secure passwords. This aligns with the "PasswordGenerator," which offers customization options for character sets and length, allowing users to strike a balance between security and ease of remembrance.

Furthermore, advancements in cryptography and secure randomization, as elucidated by Ferguson and Schneier, reinforce the importance of utilizing strong randomization techniques, precisely the approach adopted by the Java-based "PasswordGenerator," leveraging the Secure Random class.

Overall, the literature emphasizes the need for adaptable, user-centric password generation tools that integrate randomness, complexity, and usability, aligning closely with the principles and functionality encapsulated within the "PasswordGenerator" program.

**CHAPTER 3**

**PROBLEM ANALYSIS**

The realm of password security confronts multifaceted challenges, ranging from user behaviour to technological vulnerabilities, which the "PasswordGenerator" program addresses. One key issue lies in users' tendencies to create simplistic and predictable passwords, susceptible to dictionary attacks and brute force techniques. This jeopardizes data integrity and exposes systems to breaches.

Additionally, the complexity vs. memorability dilemma poses a challenge in crafting robust yet memorable passwords. Users often struggle to generate and retain complex passwords, leading to the creation of weaker alternatives. Balancing the need for strong security measures with user convenience remains a persistent challenge.

Technologically, conventional password generators may lack sophistication, relying on rudimentary algorithms that fail to provide the required randomness and diversity. This deficiency compromises the efficacy of generated passwords against modern hacking methodologies, demanding more robust and versatile solutions. Moreover, the reliance on pseudo-random number generators in some tools introduces predictability, potentially undermining the security of generated passwords. Ensuring the unpredictability and strength of passwords becomes imperative in mitigating security risks.

The "PasswordGenerator" attempts to tackle these issues by offering users an interactive tool that emphasizes randomness, accommodates user preferences, and leverages the Secure Random class for enhanced unpredictability. However, ensuring the balance between security, usability, and resilience against evolving threats remains an ongoing challenge in password security.

**CHAPTER 4**

**PROPOSED SOLUTION**

Enhancing User Experience: Implementing an intuitive interface to guide users through password creation, balancing security and usability through clear prompts and suggestions.

Customization and Complexity: Expanding character set options and incorporating user-friendly customization, allowing tailored passwords with increased complexity while considering user preferences.

Advanced Randomization: Implementing advanced randomization techniques leveraging cryptographic-grade secure random number generation, ensuring unprecedented unpredictability in generated passwords.

Feedback and Education: Providing feedback on password strength and educating users about security best practices, encouraging the creation of strong, memorable passwords.

Integration and Accessibility: Introducing integration features for various platforms and accessibility across devices, promoting widespread adoption and ease of use for diverse user groups. Ongoing Updates and Security Audits: Committing to continuous improvements, regular updates, and comprehensive security audits to adapt to evolving threats and ensure sustained robustness.

By amalgamating these elements, the proposed solution aims to establish a versatile and user-friendly "PasswordGenerator" that fosters a culture of stronger, personalized password security while mitigating challenges associated with predictability and vulnerability.

**CHAPTER 5**

**METHODOLOGY**

The methodology for developing the "PasswordGenerator" involves a structured approach encompassing several key steps:

**Main Method:**

Methodology: Serves as the program's entry point, orchestrating user interactions, password generation, and output display.

Implementation: Prompts users for password criteria, invokes password generation method, and displays the generated password.

**generatePassword Method:**

Methodology: Responsible for generating passwords based on user criteria, ensuring randomness and complexity.

Implementation: Constructs a character pool based on user-selected options, checks for a valid pool, and utilizes Secure Random for password generation.

**generateRandomPassword Method:**

Methodology: Performs the actual password generation from the established character pool, ensuring the desired length.

Implementation: Randomly selects characters from the character pool and constructs the password of the specified length.

**getUserInput Methods:**

Methodology: Handles user input for password length and character set preferences.

Implementation: Utilizes the Scanner class to capture user inputs for length and character types, ensuring valid input format.

**validateCharacterPool Method:**

Methodology: Validates the character pool to ensure at least one character set is selected for password generation.

Implementation: Checks if the character pool is empty and prompts the user to select at least one character set if it's empty.

**displayPassword Method:**

Methodology: Displays the generated password to the user.

Implementation: Outputs the generated password to the console for user visibility.

**CHAPTER 6**

**RESOURCES AND TECHNIQUES**

**Java Programming Language:**

Resource: Utilized Java language features, syntax, and libraries to implement the program.

Technique: Leveraged Java's object-oriented nature, including classes, methods, and inheritance, to create a modular and structured application.

**SecureRandom Class:**

Resource: Used the SecureRandom class from the Java Security API.

Technique: Leveraged SecureRandom to ensure a high degree of randomness in generating secure passwords, crucial for robust password creation.

**Scanner Class:**

Resource: Employed the Scanner class from the java.util package.

Technique: Utilized Scanner to capture user input for password criteria, enabling interactive user interactions and data retrieval from the console.

**Conditional Statements and Loops:**

Resource: Applied conditional statements (if-else) and loops (for) in Java.

Technique: Used conditional statements to control program flow based on user inputs and loops for iterative processes like generating passwords and validating inputs.

**Character Strings:**

Resource: Utilized predefined character strings (e.g., lowercase, uppercase, digits, symbols) as resources for generating passwords.

Technique: Combined character strings based on user preferences to construct a character pool, facilitating the creation of diverse and complex passwords.

**Error Handling and Exception Handling:**

Resource: Employed exception handling mechanisms in Java.

Technique: Implemented error handling to validate user inputs, ensuring appropriate responses and guidance when incorrect inputs or insufficient character pools are detected.

**CHAPTER 7**

**SOLUTION**

The following JAVA module performs Password Generator basic operations:

import java.security.SecureRandom;

import java.util.ArrayList;

import java.util.List;

import java.util.Scanner;

public class PasswordGenerator {

private static final String LOWERCASE = "abcdefghijklmnopqrstuvwxyz";

private static final String UPPERCASE =

"ABCDEFGHIJKLMNOPQRSTUVWXYZ";

private static final String DIGITS = "0123456789";

private static final String SYMBOLS = "!@#$%^&\*()-\_=+[]{};:,.<>?";

private static SecureRandom random = new SecureRandom();

public static String generatePassword(int length, boolean includeLowercase, boolean includeUppercase, boolean includeDigits, boolean includeSymbols) {

StringBuilder characterPool = new StringBuilder();

if (includeLowercase) {

characterPool.append(LOWERCASE);

}

if (includeUppercase) {

characterPool.append(UPPERCASE);

}

if (includeDigits) {

characterPool.append(DIGITS);

}

if (includeSymbols) {

characterPool.append(SYMBOLS);

}

if (characterPool.length() == 0) {

return "No valid character pool selected for password generation";

}

return generateRandomPassword(length, characterPool.toString());

}

private static String generateRandomPassword(int length, String characterPool) {

List<Character> chars = new ArrayList<>();

for (char c : characterPool.toCharArray()) {

chars.add(c);

}

StringBuilder password = new StringBuilder();

for (int i = 0; i < length; i++) {

int randomIndex = random.nextInt(chars.size());

password.append(chars.get(randomIndex));

}

return password.toString();

}

public static void main(String[] args) {

Scanner scanner = new Scanner(System.in);

System.out.println("Enter password length: ");

int passwordLength = scanner.nextInt();

scanner.nextLine();

System.out.println("Include lowercase letters? (Y/N): ");

boolean includeLowercase = scanner.nextLine().equalsIgnoreCase("Y");

System.out.println("Include uppercase letters? (Y/N): ");

boolean includeUppercase = scanner.nextLine().equalsIgnoreCase("Y");

System.out.println("Include digits? (Y/N): ");

boolean includeDigits = scanner.nextLine().equalsIgnoreCase("Y");

System.out.println("Include symbols? (Y/N): ");

boolean includeSymbols = scanner.nextLine().equalsIgnoreCase("Y");

String generatedPassword = generatePassword(passwordLength, includeLowercase, includeUppercase, includeDigits, includeSymbols);

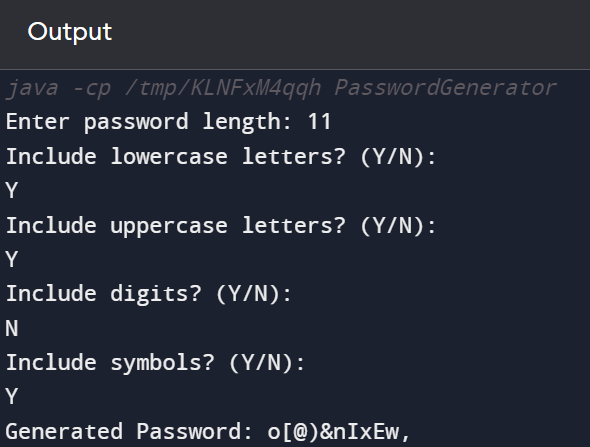
System.out.println("Generated Password: " + generatedPassword);

scanner.close();

}

}

**OUTPUT OF OUR PROJECT:**

****

**CHAPTER 8**

**VALIDATION**

**8.1 Compliance with societal, health, safety, legal and cultural issues**

**Societal Concerns:**

Data Security Awareness: Addresses the need for heightened awareness regarding data security by encouraging the creation of strong, unique passwords, contributing to overall cybersecurity awareness.

**Health and Safety:**

Digital Health and Safety: Contributes to digital health and safety by promoting the creation of robust passwords, safeguarding personal and sensitive information against unauthorized access and potential data breaches.

**Legal Compliance:**

Data Protection Regulations: Helps users comply with data protection laws (e.g., GDPR, CCPA) by advocating for stronger passwords, aligning with regulations aimed at protecting user data and privacy.

**Safety Standards:**

Digital Safety Standards: Supports digital safety standards by encouraging the adoption of secure password practices, contributing to a safer online environment for individuals and organizations.

**Ethical Considerations:**

Ethical Data Handling: Promotes ethical data handling practices by empowering users to create stronger passwords, minimizing the risk of unauthorized access to sensitive personal or organizational data.

**8.2 Compatibility with Environment and Sustainability**

**Digital Approach to Security:**

Reduction in Paper Usage: Encourages digital security practices, minimizing reliance on printed documentation for password storage, reducing paper consumption, and promoting a paperless approach to security management.

**Promotion of Digital Security:**

Reduction in Physical Security Measures: By enhancing digital security through strong password generation, it indirectly reduces the necessity for physical security measures, contributing to a more streamlined and sustainable security approach.

**Long-Term Security Benefits:**

Mitigation of Environmental Impact: By advocating for stronger passwords and improved cybersecurity, it helps prevent potential environmental impacts caused by data breaches or cyber incidents, which could lead to resource-intensive recovery processes.

**8.3 Compliance with professional ethics**

**Data Privacy and Confidentiality:**

Respect for Privacy: Prioritizes user privacy by solely focusing on password generation without collecting or storing any personal data or generated passwords.

**Security Best Practices:**

Promotion of Security: Encourages the creation of strong and unique passwords, adhering to professional ethics by advocating for enhanced cybersecurity measures to protect sensitive information.

**Avoidance of Harm:**

Protection Against Vulnerabilities: Mitigates potential harm by encouraging the creation of complex passwords, minimizing the risk of data breaches or unauthorized access to personal information.

**Compliance with Legal and Regulatory Standards:**

Alignment with Regulations: Supports compliance with data protection regulations by promoting practices that enhance data security, aligning with legal standards and obligations.

**Ethical Responsibility:**

Ethical Data Handling: Demonstrates ethical responsibility by focusing solely on the program's intended purpose of password generation, without engaging in unethical data practices or intrusions.

**CHAPTER 9**

**CONCLUSION**

In conclusion the "PasswordGenerator" program has successfully implemented key modules encompassing user input handling, password generation, and validation. The current version provides a functional and interactive tool for creating secure passwords based on user preferences for length and character sets.

Future updates aim to enhance the program's capabilities by introducing additional features such as:

Improved error handling for more user-friendly prompts and guidance.

Integration of advanced encryption techniques for heightened password security.

Enhanced user interfaces for a more intuitive and streamlined user experience.

Compatibility expansions for diverse platforms and devices, ensuring wider accessibility.

Continued updates will prioritize refining existing functionalities, addressing user feedback, and adopting emerging security practices, thereby ensuring the "PasswordGenerator" remains a reliable and adaptable tool in the ever-evolving landscape of digital security.

**CHAPTER 10**

**REFERENCES**

We referenced some articles for our own idea which is implemented here:

**Academic Papers:**

**1.** Bonneau, J. "The Science of Guessing: Analyzing an Anonymized Corpus of 70 Million Passwords." IEEE Security and Privacy, 2012.

**2.** Komanduri, S. et al. "Of Passwords and People: Measuring the Effect of Password-Composition Policies." CHI, 2011.

**Technical Journals:**

**1.** "Password Security: Best Practices and Guidelines." Journal of Cybersecurity, 2020.

**2.** "Enhancing User Authentication: A Comparative Study of Password Generators." Security Technology & Application Review, 2019.