Theory of Automata Project

Brute-Force Attack Detection Using Pushdown Automaton (PDA)

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Project Overview

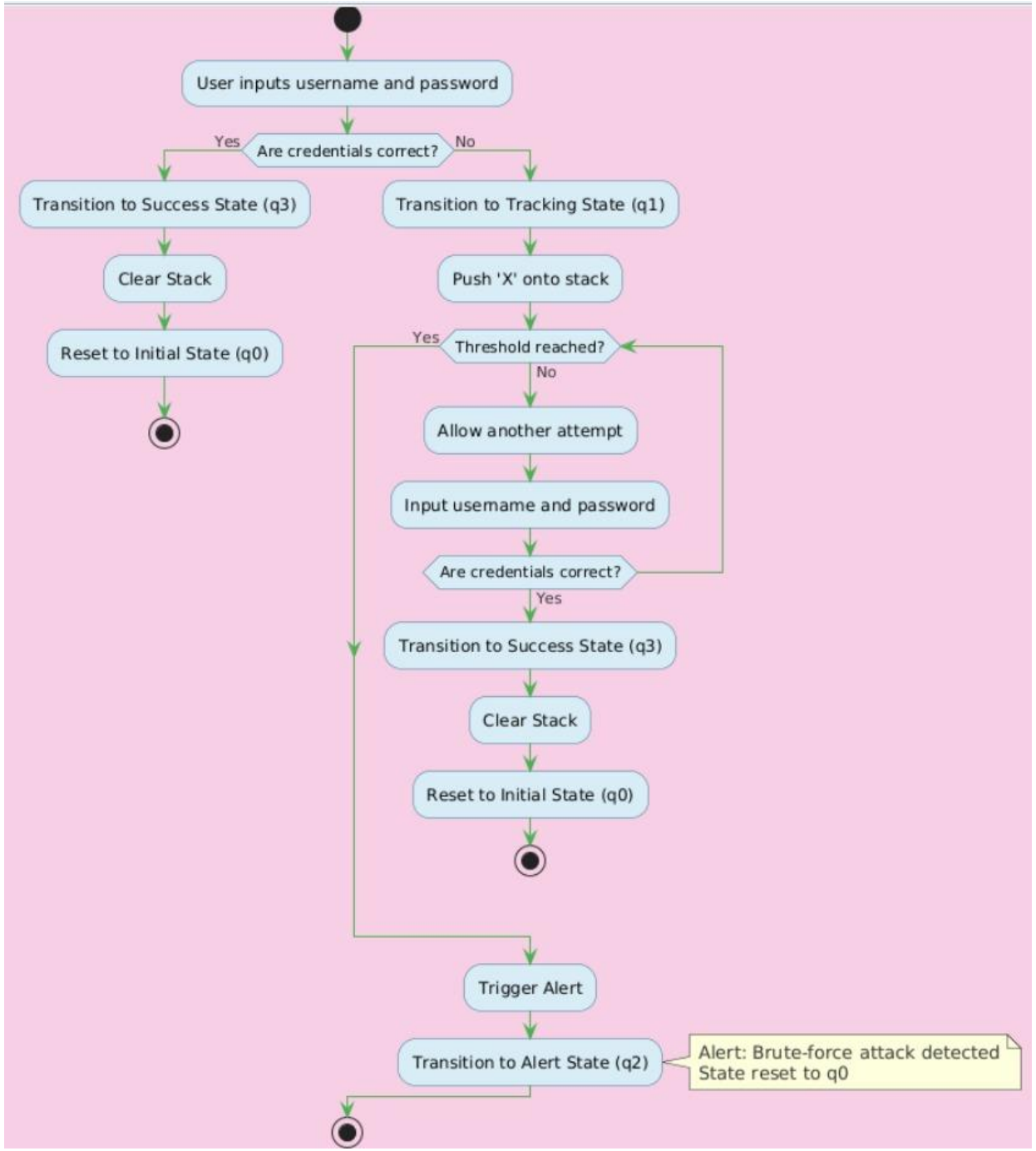
This project demonstrates the design and implementation of a Pushdown Automaton (PDA) to detect brute-force login attempts based on a predefined threshold of failed login attempts. The PDA transitions between states—initial, tracking, alert, and success–based on user behavior. A Flask-based web application simulates login attempts, integrating PDA transitions with session management. A visualization module illustrates PDA state transitions using NetworkX and Matplotlib. The project showcases how automata theory can solve real-world cybersecurity problems, providing a foundation for future enhancements in anomaly detection.

Problem Statement And Objectives

To develop an automata-based system that identifies brute-force attacks by monitoring login attempts and triggering alerts upon exceeding a failure threshold.

Objectives :

1. Model user login behavior with PDA states and transitions.
2. Detect brute-force attempts in real-time.
3. Provide an intuitive visualization of state transitions



Project Workflow

Methodology

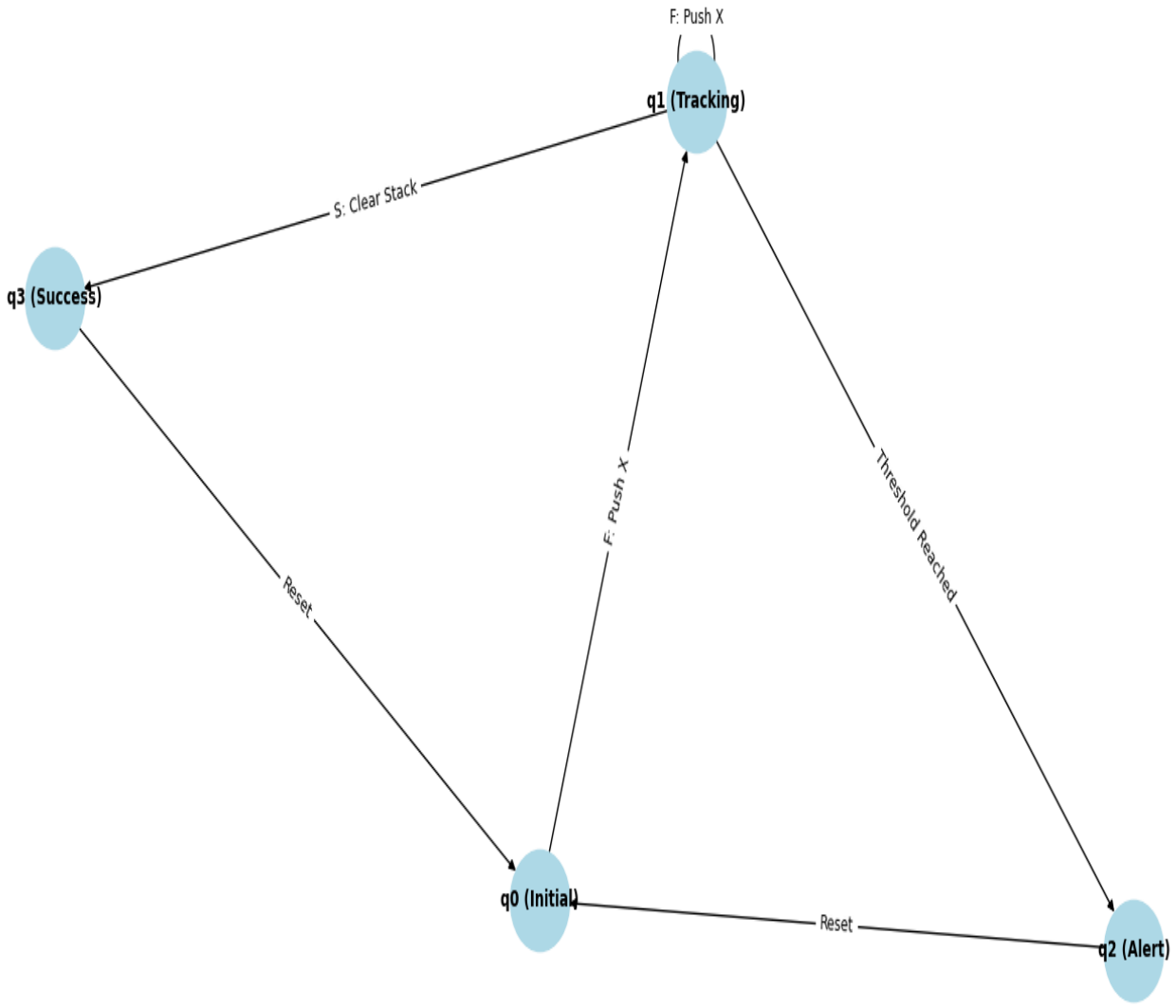
1. **Requirement Analysis:** Define PDA states, transitions, and input symbols.

2. **System Design:** Develop PDA logic and integrate it into a web application.

3. **Testing: Validate** the system with sample login attempts.

Code and Environment

- **Programming Languages:** Python
- **Libraries:** Flask, NetworkX, Matplotlib


F: Push X
q1 (Tracking)
S: Clear Stack
q3 (Success)
Reset
F: Push X
Threshold Reached
q0 (Initial)
Reset
q2 (Alert)

PDA Graph

Conclusion And Future Work

The project successfully demonstrates a PDA-based approach to detect brute-force login attempts. It integrates theoretical concepts with practical implementation, showcasing the applicability of automata theory in cybersecurity.

Future Work :

1. Extend support for multi-user detection.
2. Integrate with live authentication systems.
3. Enhance visualization with real-time updates

Thank you

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