DESIGN AND IMPLEMENTATION OF A FINANCIAL MANAGEMENT SYSTEM FOR SAVINGS FUNDS

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The Motivation for Choosing this Project

- Financial challenges faced by individuals and their reliance on bank loans
  - Stringent loan approval criteria
  - High-interest rates loans
- Establishment of private savings funds
  - Reliance on traditional and manual methods
  - Utilization of general accounting software
  - The adoption of a fund management application

Drawbacks in Traditional Administration Methods

- Potential calculation errors caused by accountants
- Significant monthly time spent on audits by accountants
- Lack of a follow-up mechanism for members' payments
- Time-consuming monthly recording of members' payments
- Manual calculation of loan allocation plans for future periods

Drawbacks in the Administrative Experience of General Applications

- Potential calculation errors caused by accountants
- Significant monthly time spent on audits by accountants
- Lack of a follow-up mechanism for members' payments
- Time-consuming monthly recording of members' payments
- Manual calculation of loan allocation plans for future periods
- Inclusion of unnecessary tools irrelevant to savings funds
- Software complexity and difficulty of use for regular users

Drawbacks in the Administrative Experience of Fund Management Applications

- Potential calculation errors caused by accountants
- Significant monthly time spent on audits by accountants
- Lack of a follow-up mechanism for members' payments
- Time-consuming monthly recording of members' payments
- Manual calculation of loan allocation plans for future periods
- Inclusion of unnecessary tools irrelevant to savings funds
- Software complexity and difficulty of use for regular users

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The Solution to Administrative Experience Drawbacks (Project’s Purpose)

- Simplicity, user-friendliness, and ease of use
- Automation of accounting and cashiering tasks to eliminate human errors
- Automation of tracking, payment, and registration of members' debts
- Automation of account recording and member audits
- Automation of loan allocation planning for future periods

Drawbacks in User Experience of Existing Software

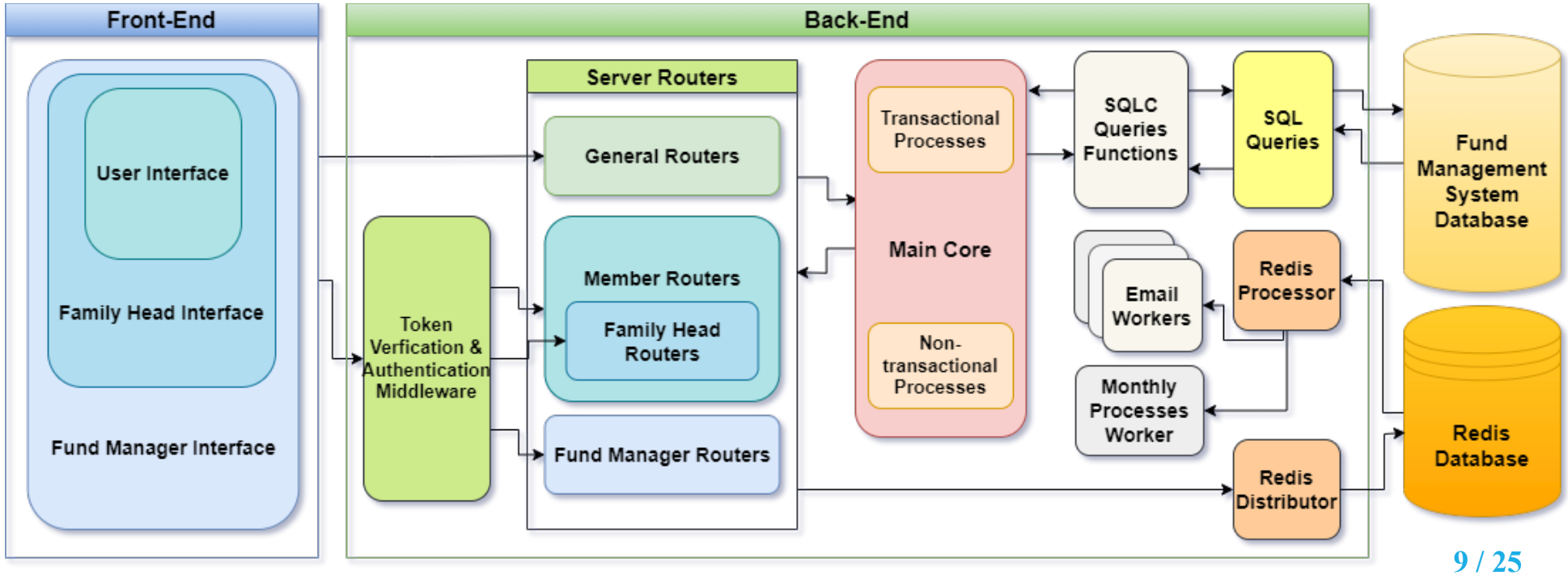
- Absence of information on loan disbursement dates and amounts for members
- Lack of member visibility into their accounts and debts
- Missing functionality to define family heads or managers
- Inability to fulfill members' requests for bigger loan disbursements
- Equal installment payments for members' loans over a period
- Ignoring annual inflation rates

The Solution to User Experience Drawbacks (Project’s Purpose)

- Allow members to view the loan's disbursement date and amount
- Enable members to access their accounts and view outstanding debts
- Introduce a family manager role to manage family members' accounts
- Provide the option to allocate a portion of members’ savings for loan repayment
- Determine members' loan amounts based on their savings contributions
- Implement annual inflation calculation for members' savings

Structure and System Architecture Design

- Application Deployment Architecture
- Implementation of Three-Tier Architecture



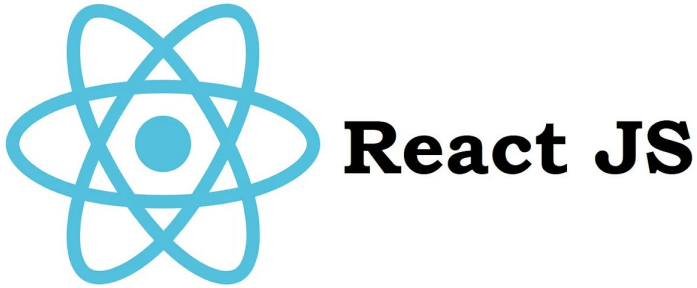
Which Database is Best Suited?

- Database Selection
  - Key-Value Stores
  - Document Stores
  - NoSQL
  - RDBMS

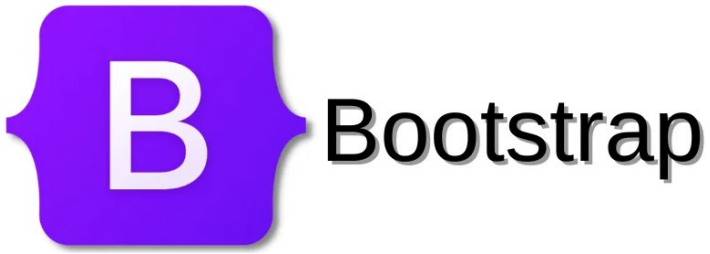
- Relational Database Management System Selection

Database and Data Model Design

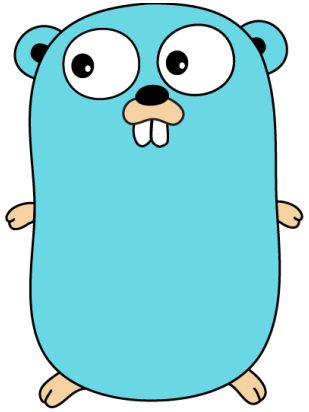
Which Front-End Framework is Best Suited?



Which CSS Framework is Best Suited?



Which Back-End Language is Best Suited?



Golang

python™

Java™

Implementation of Database Queries

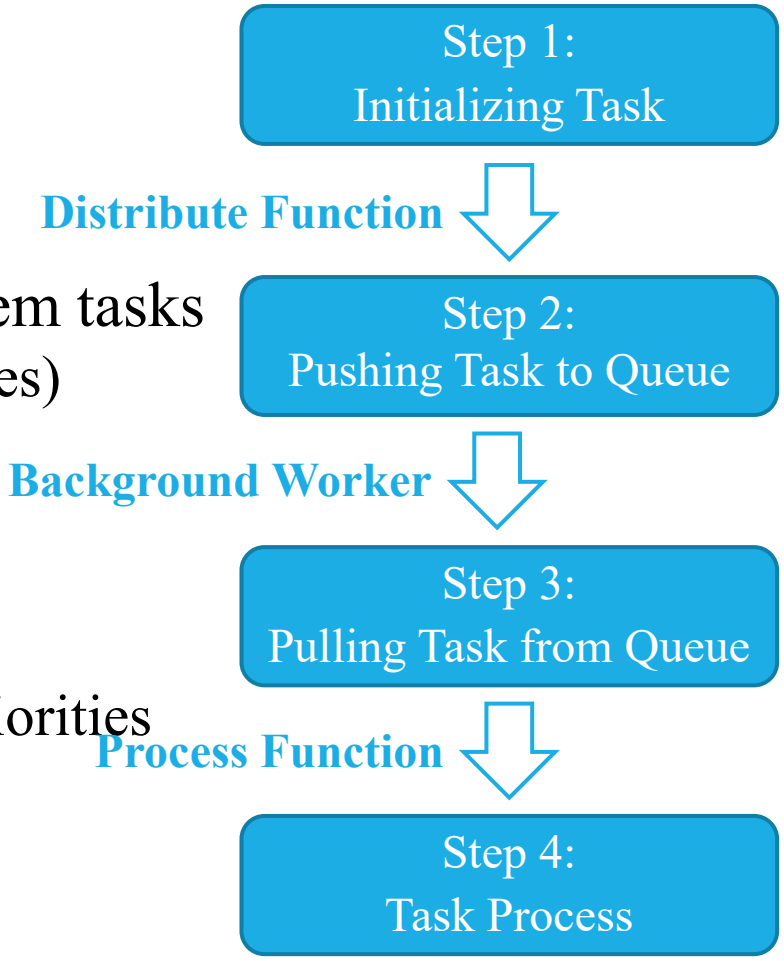
- Utilizing the Golang-Migrate library for managing database changes and versions
- Opting for an ORM (Object-Relational Mapping) framework for Go instead of raw SQL
  - GORM
  - SQLX
  - SQLC

Database Transactions

- Considering the financial nature of the savings fund management system
- Adopting a transactional approach
  - A unit of work comprises multiple database queries
  - Ensuring completion of the operation or rolling back the entire set
  - Maintaining data integrity and avoiding anomalies
- Incorporating features of ACID
  - Atomicity
  - Consistency
  - Isolation
  - Durability

Background Processes Management with Redis

- Utilizing Redis for queuing and scheduling system tasks
  - Handling email service tasks (event-based processes)
  - Managing monthly updates (periodic processing)
- Redis Features
  - Support for both in-memory and stable storage
  - Provision of three types of queues with varying priorities



Which Communication Technologies are Best Suited?

- API Protocol Selection for Client and Server Communication
  - Aim for easier development and maintenance
  - Ensure better compatibility with web standards and RDBMS

- Choosing a Framework for Implementing the Request Handling Layer
  - Prioritize frameworks with
    - A larger community
    - Simplicity
    - High speed and efficiency
    - Firmware support

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Securing User Accounts

- Implementing Password-Based Authentication Systems
- Setting Password Policies
- Utilizing the BCrypt library for password encryption, which includes:
  - Salting
  - Hashing
- Implementing Token-based Authentication

Token-based Authentication Protocol Selection

PASETO

vs

JWT

No need to choose an algorithm, as it has two versions and two sets of keys (local and public)

Known attacks:

The inability to choose or change the algorithm,
Authenticate all requests

Offers a variety of algorithm choices, including some vulnerable ones

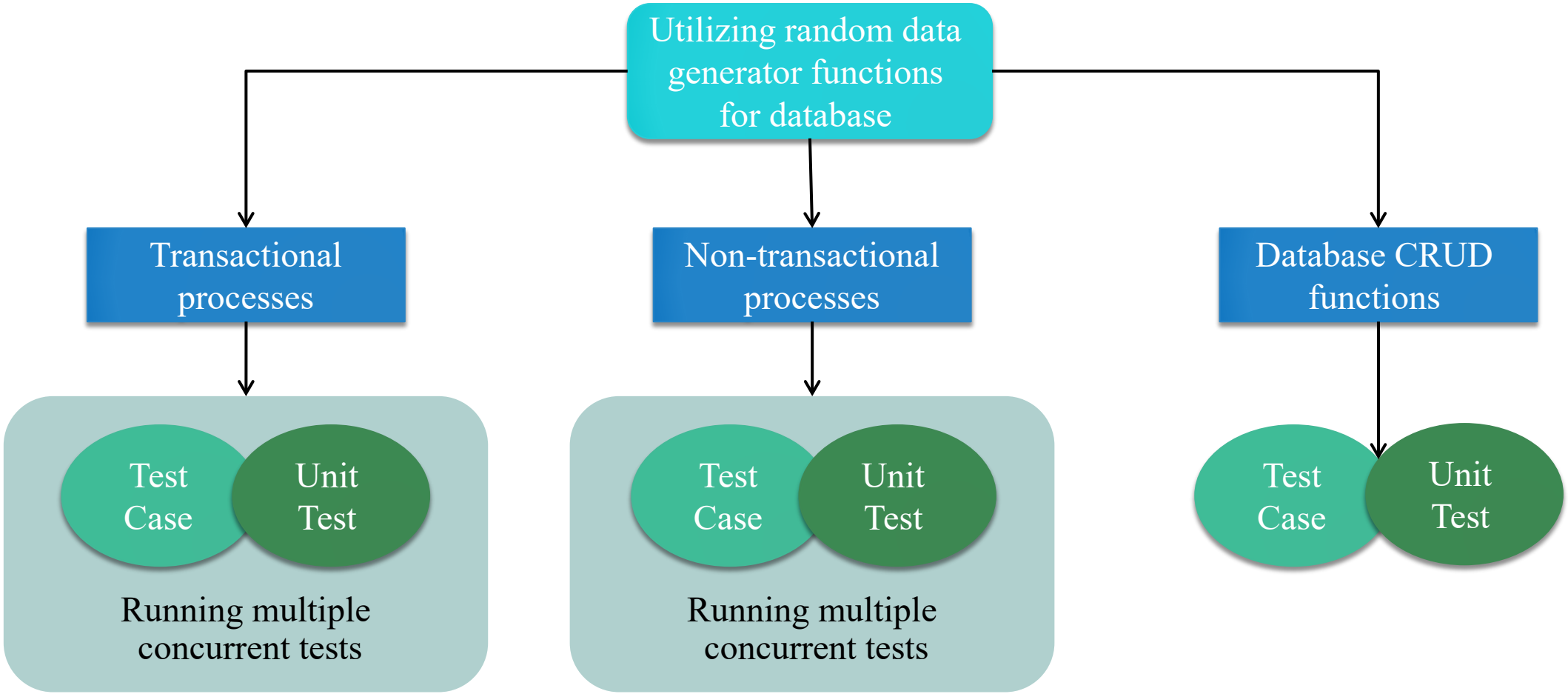
Known attacks:

Changing the alg to 'none’,
Changing alg to HS256 instead of RSA public key

Users Access Control with Tokens

- Implementing Token-based authentication with:
  - Password hashing
  - Tokens expiring every 10 minutes
- Managing sessions with refresh tokens to:
  - Refresh access tokens and maintain session despite HTTP statelessness
  - Tokens expiring every 24 hours
- Implementing Role-Based Access Control (RBAC) by:
  - Defining three roles: member, family head, and manager
  - Verifying user identity with tokens

Testing and Quality Assurance of the System



Implementation and Test Results

- Utilizing the Go Framework for unit testing
  - Performing Unit Tests
  - Defining Test Cases
- Writing and executing tests independently
- Test Results
  - Achieving 81% coverage of the program by unit tests
  - Covering the remaining aspects with test cases

Suggestions for Future Developments

- Defining the inspector role
  - Prevent abuse and potential monopolies in system management
  - Monitor the actions of the fund manager closely
  - Require approval for decisions related to the manager’s personal interests
- Diversifying loan options
  - Offering additional loans such as essential, student, and marriage loans
  - Requiring approval from the manager
  - Promoting greater flexibility and financial support for members
- Managing multiple independent funds simultaneously
  - Creating and managing several independent savings funds within a single system
  - Facilitating commercial expansion of the system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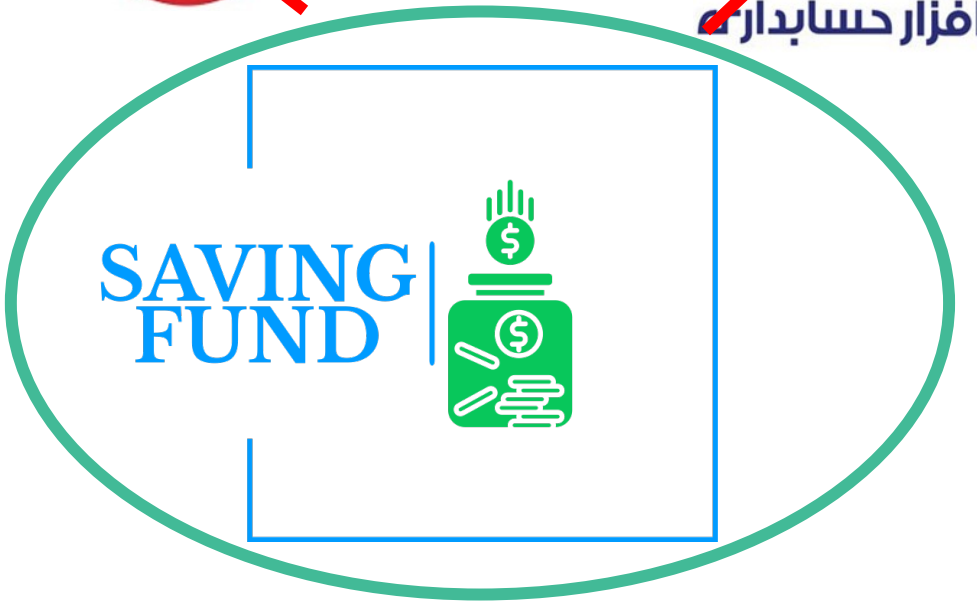
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