DESIGN AND IMPLEMENTATION OF A FINANCIAL MANAGEMENT SYSTEM FOR SAVINGS FUNDS

Negar Karami

Supervisor Professor
Dr. Hamed Farbeh

Computer Engineering Department

Amirkabir University of Technology
(Tehran Polytechnic)

Computer Engineering Department

September 2023

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

Weaknesses 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

RayaSepehr
Information Technologies Co.

سدنا
SEDNA

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

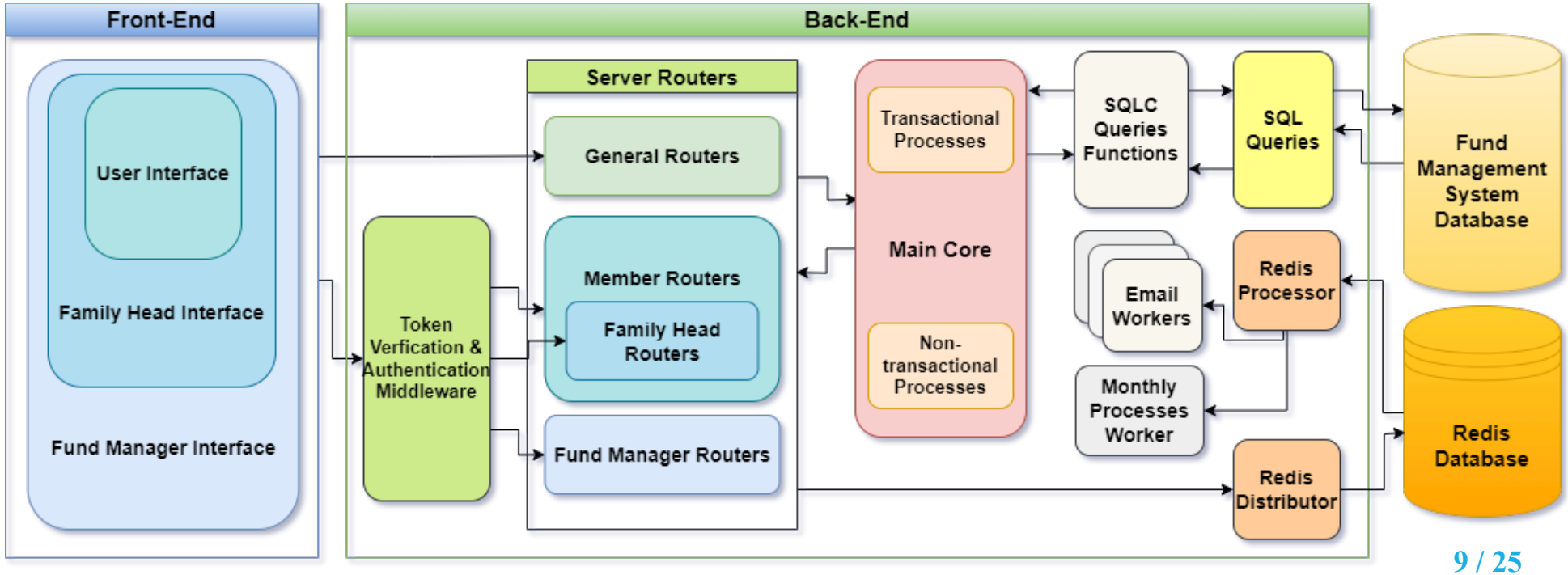
- Absence of information on loan disbursement dates and amounts for members
- Lack of member visibility into their accounts and debts
- Missing functionality to define family heads or managers
- Inability to fulfill members' requests for bigger loan disbursements
- Equal installment payments for members'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



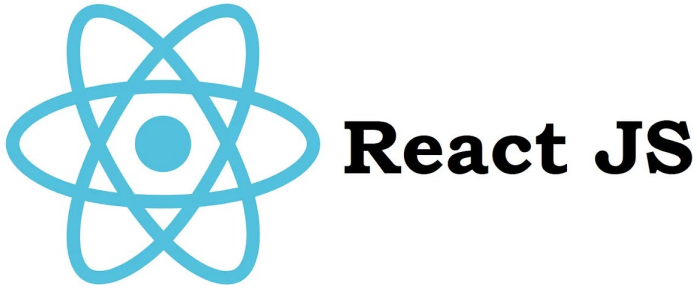
Which Database is Best Suited?

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

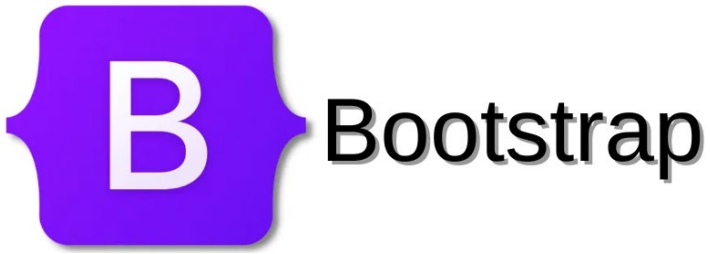
- Relational Database Management System Selection

Database and Data Model Design

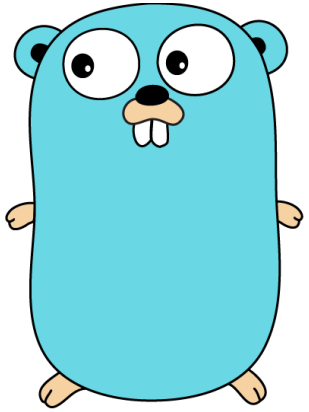
Which Front-End Framework is Best Suited?



Which CSS Framework is Best Suited?



Which Back-End Language is Best Suited?



Golang

python™

Java™

Implementation of Database Queries

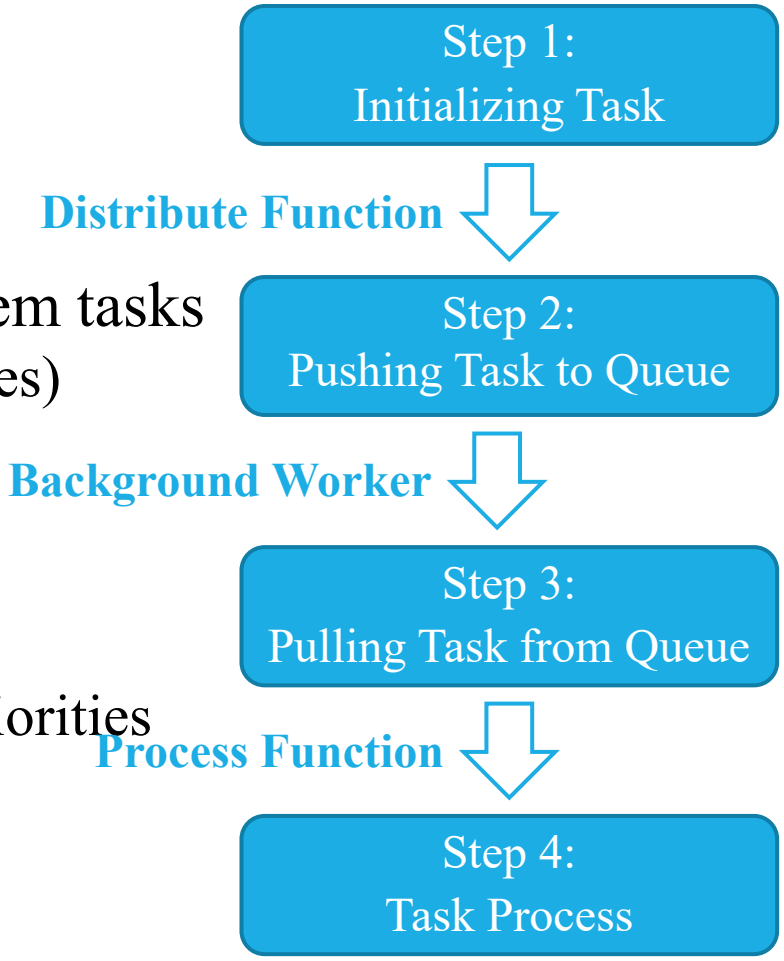
- Utilizing the Golang-Migrate library for managing database changes and versions
- Opting for an ORM (Object-Relational Mapping) framework for Go instead of raw SQL
  - GORM
  - SQLX
  - SQLC

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

Gin

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

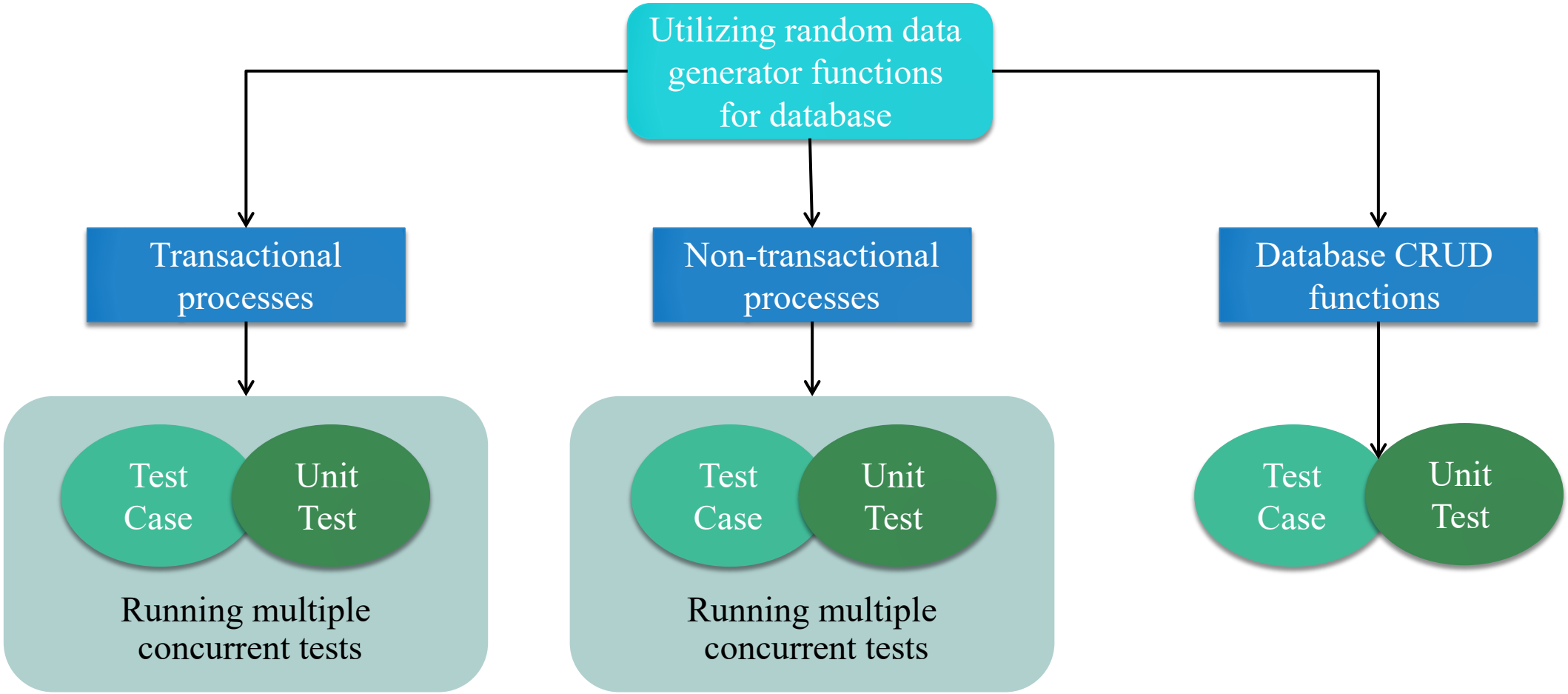
Known attacks:

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

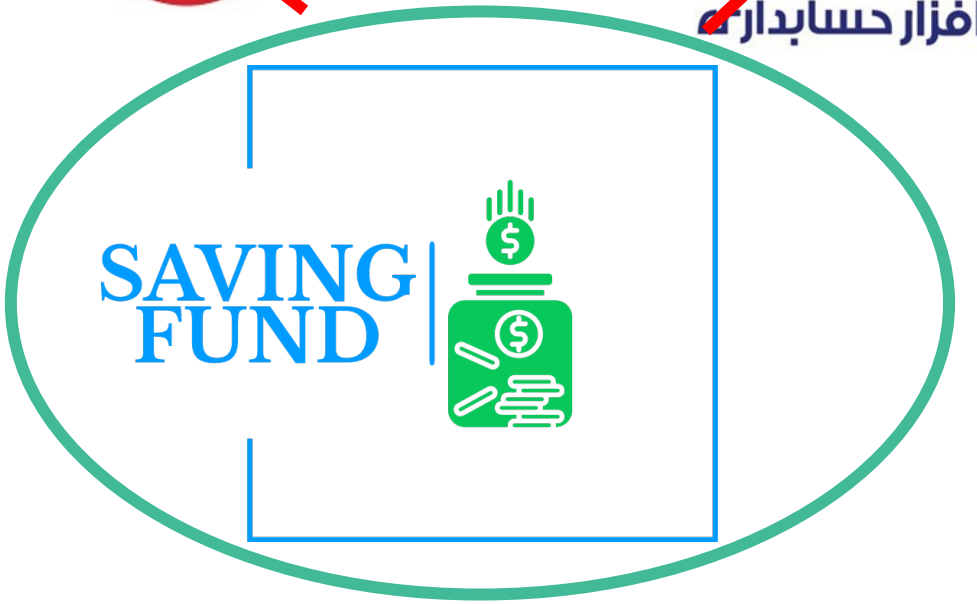
- Defining the inspector role
  - Prevent abuse and potential monopolies in system management
  - Monitor the actions of the fund manager closely
  - Require approval for decisions related to the manager’s personal interests
- Diversifying loan options
  - Offering additional loans such as essential, 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


www.yeganehsoft.ir
صندوق قرض الحسنه
SoftGozin.com


هلو
HALOO


نرم افزار حسابداری


دفتر معین


SAVING
FUND


RayaSepehr
Information Technologies Co.


سدنا
SEDNA
Accounting & Billing


سایگان سیستم
مهندسی نرم افزار


Gheyas
softwares


دفتر صندوق