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

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The Motivation for Choosing this Project

- People's financial problems and the need to get loans from banks
  - Hard conditions to get a loan
  - High interest loans
- Establishment of private savings funds
  - Utilization of the traditional and manual method
  - Using general accounting software
  - Using fund management application

Traditional Methods' Administrative Part's Weaknesses

- Possible calculation errors caused by the accountant
- Spending a lot of time monthly doing audits by the accountant
- Absence of a follow-up mechanism for members' payments
- Spending a lot of time monthly recording members' payments
- Manual calculation of the loan allocation plan for future period

General Applications' Administrative Part's Weaknesses

- Possible calculation errors caused by the accountant
- Spending a lot of time monthly doing audits by the accountant
- Absence of a follow-up mechanism for members' payments
- Spending a lot of time monthly recording members' payments
- Manual calculation of the loan allocation plan for future period
- Having many tools not useful for savings funds
- Software complexity and Hard to use for regular users

Fund Management Softwares' Administrative Part's Weaknesses

- Possible calculation errors caused by the accountant
- Spending a lot of time monthly doing audits by the accountant
- Absence of a follow-up mechanism for members' payments
- Spending a lot of time monthly recording members' payments
- Manual calculation of the loan allocation plan for future period
- Having many tools not useful for savings funds
- Software complexity and Hard to use for regular users

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The Solution for Administrative Part (Project's Purpose)

- Simplicity, user-friendly, and easy and convenient use
- Automating accounting and cashiering responsibilities and eliminating their human factor
- Automating the tracking, payment and registration of members' debts
- Automating recording accounts and conducting member audits
- Automating the loan allocation planning for the future period

Existing Software's User Part's Weaknesses

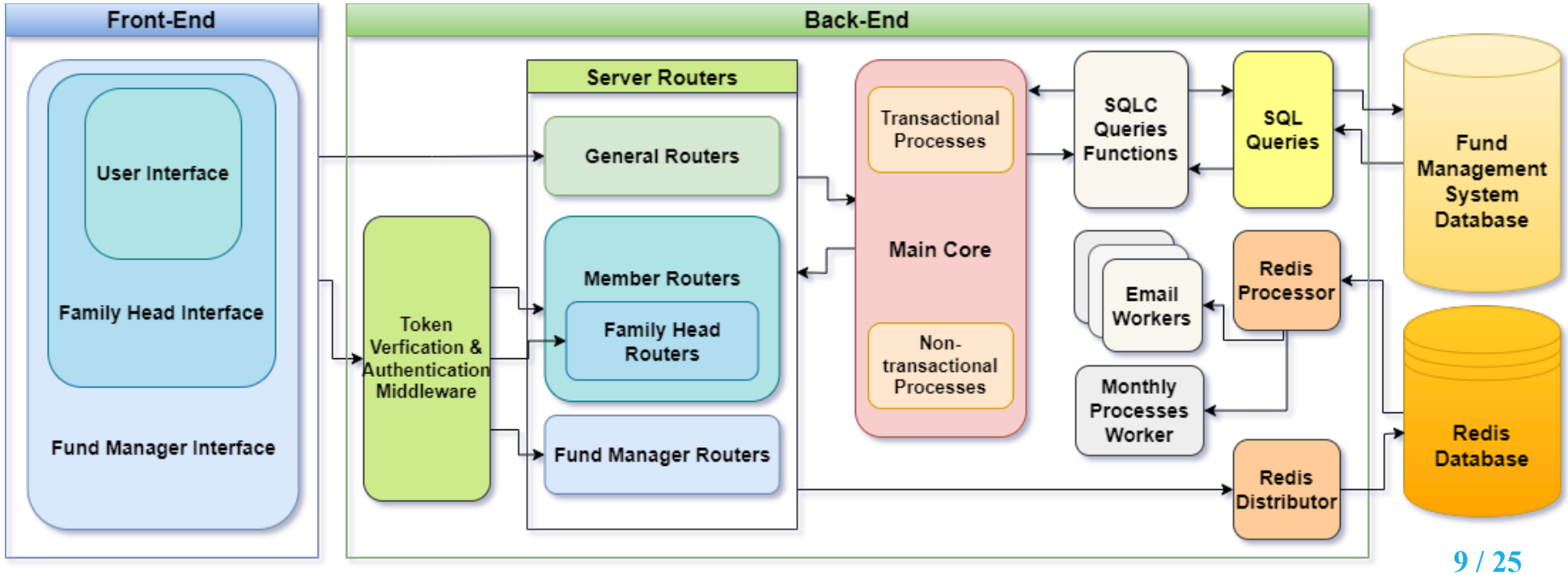
- No Information for members about the loan’s receiving date and its amount
- No Information for members about their accounts and debts
- No definition for family head or manager
- No possibility for accepting members' requests to pay receive bigger loans
- Paying members' loans in equal amounts during a period
- Ignoring annual inflation

The Solution for User Part (Project’s Purpose)

- Members ability to see the loan’s receiving date and its amount
- Members ability to view their account and remaining debts
- Defining a role for the family manager to handle family members’ accounts
- A possibility for members to determine the savings share for the loan amount
- Determining the loan amount of members according to their savings
- Calculating annual inflation for members' savings

Structure and System Architecture Design

- Application Deployment Architecture
- Three-Tier Architecture

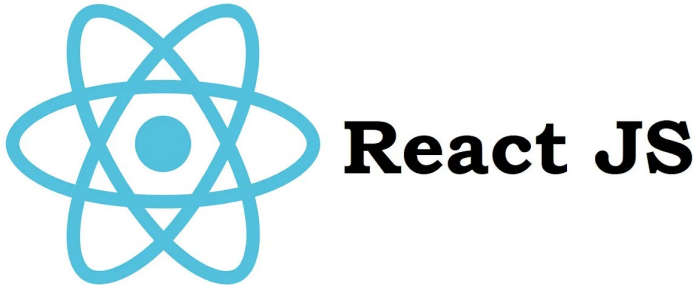


Which Database is Best Suited?

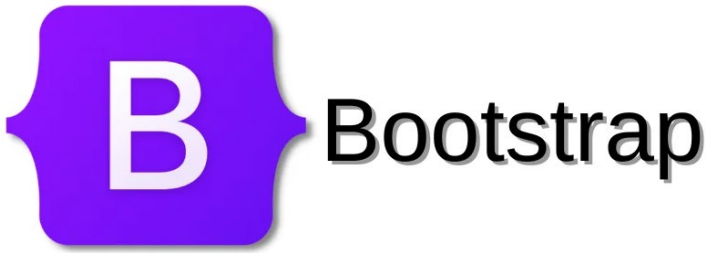
- Database selection
  - Key-Value Stores
  - Document Stores
  - NoSQL
  - RDBMS
- Relational database management system selection

Database and Data Model Design

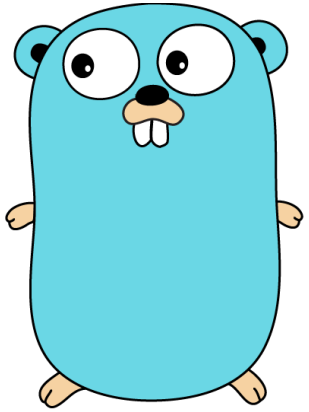
Which Front-End Framework is Best Suited?



Which CSS Framework is Best Suited?



Which Back-End Language is Best Suited?



Golang

python™

Java™

Implementation of Database Queries

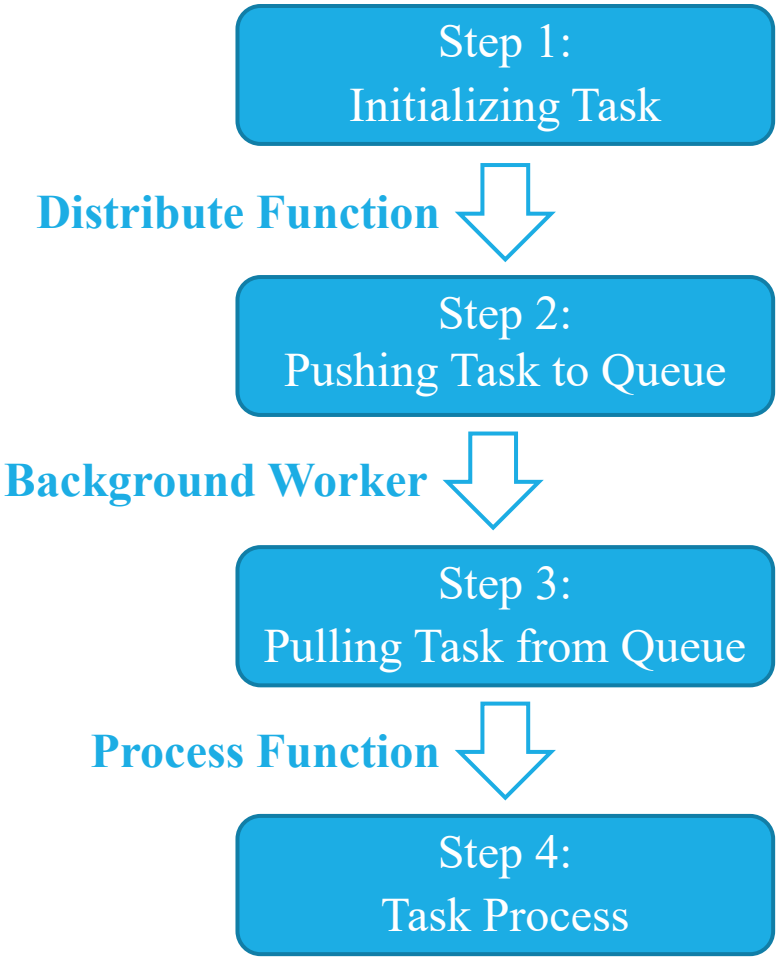
- Using the Golang-Migrate library to manage database changes and versions
- Not using raw SQL and choosing an ORM framework for Go
  - GORM
  - SQLX
  - SQLC

Database Transactions

- The financial nature of the savings fund management system
- Transactional approach
  - A unit of work consists of several database queries
  - Ensuring that the operation is completed or the whole set is rolled back
  - Maintain data integrity
  - Avoiding anomalies
- Features ACID
  - Atomicity
  - Consistency
  - Isolation
  - Durability

Background Processes Management with Redis

- Queuing and scheduling system tasks
  - Email service tasks (event-based processes)
  - Monthly updates (periodic processing)
- Redis Features
  - Support for in-memory and stable storage
  - Three types of queues with different priorities



Which Communication Technologies are Best Suited?

- API protocol selection for client and server communication
  - Easier development and maintenance
  - Better compatibility with web standards and RDBMS

- Choosing a framework for implementing the request handling layer
  - The larger community
  - simple
  - High speed and efficiency
  - Firmware support

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Securing User Accounts

- Password-Based Authentication Systems
- Set Password Policies
- Using the BCrypt library for crypting the passwords
  - Salting
  - Hashing
- Token-based authentication

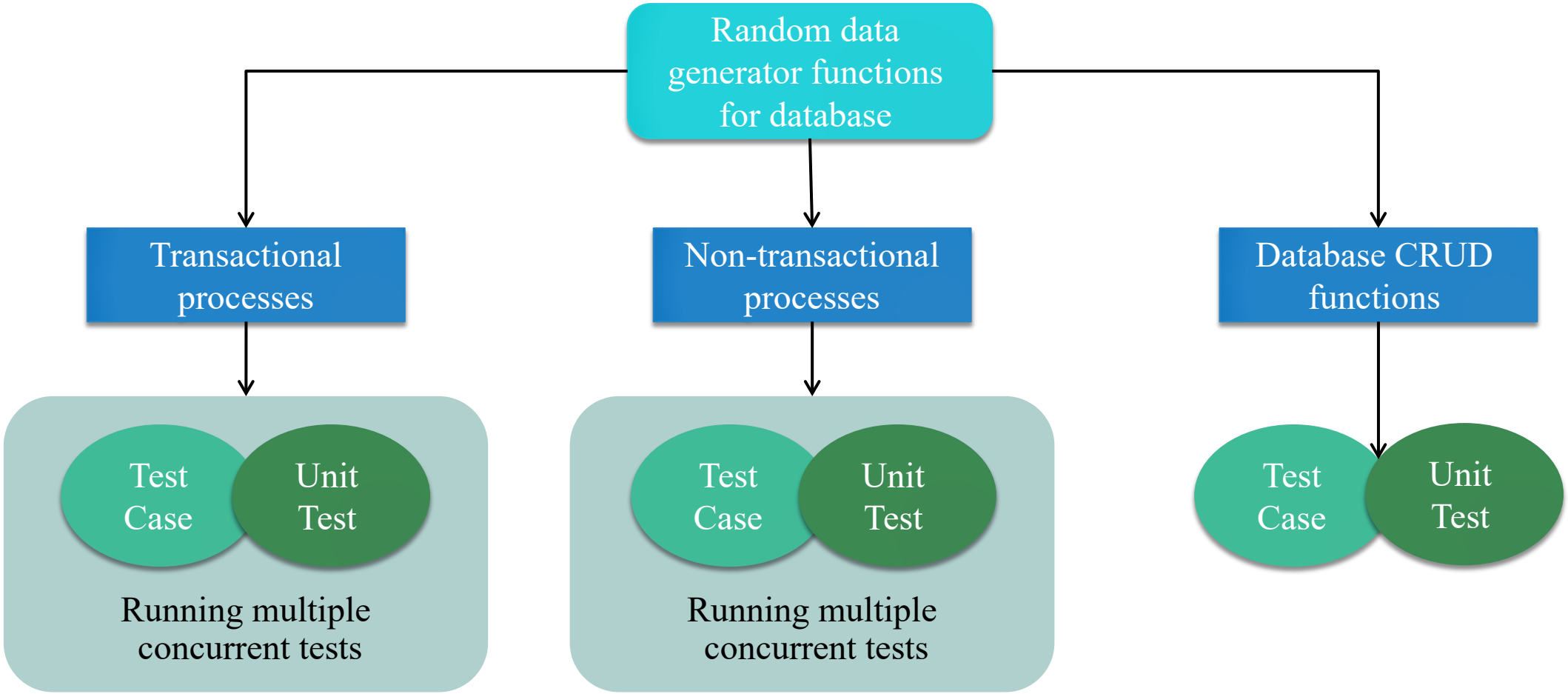
Token-based Authentication Protocol Selection

PASETO	VS	JWT
No need to choose an algorithm, has two versions, It has two local and public keys		variety of algorithms choice, including some vulnerable algorithms
Known attacks: The inability to choose or change the algorithm, Authenticate all requests		Known attacks: change the alg to none, change alg to HS256 instead of RSA public key

Users Access Control with Tokens

- Token-based authentication
  - Hashing password
  - Token expires every 10 minutes
- Session management with refresh tokens
  - Refresh access token and maintaining the session despite HTTP statelessness
  - Token expires every 24 hour
- Role-Based Access Control (RBAC)
  - Defining the three roles of member, family head and manager
  - Checking the user's identity with token

Testing and Quality Assurance of the System



Implementation and Test Results

- Go Framework test
  - Unit Test
  - Test Case
- Writing and executing tests independently
- Test results
  - 81% coverage of the program by unit tests
  - Coverage of the rest with test cases

Suggestions for Future Developments

- Defining the inspector role
  - Preventing abuse and possible monopolies in system management
  - Close monitoring of the actions of the fund manager
  - Providing approval for decisions related to the manager's personal interests
- Diversify loan options
  - Providing additional loans, such as essential, student, and marriage loans
  - Requires approval from the manager
  - Promote greater flexibility and financial support for members
- Managing multiple independent funds at the same time
  - Creating and managing several independent savings funds in a single system
  - Commercial expansion of the system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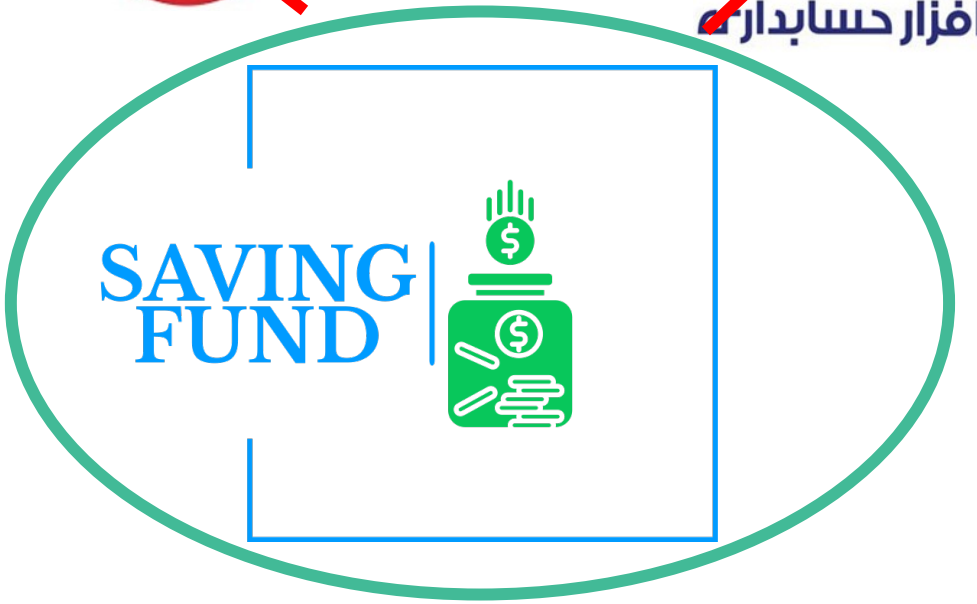
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